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SOME PRINCIPLES IN ABDOMINAL SURGERY[1]

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IT is but fitting at the opening night of our annual meeting that we should pause for a few minutes to do reverence and honor to the memory of America's greatest teacher and Chicago's master surgeon. Here we have the environment, the atmosphere which played so great a part in the making of Murphy, for in him was personified the intensive energy of this great city of the Middle West. He grew with it, he gloried in it; in his work and in his teaching there was ever the thrill and the romance of the pioneer. The boundless energy of the growing West was in his blood and into surgery he brought that dynamic force and zeal which were in keeping with the eager and restless activities around him. Pre-eminently at this meeting, held in the arena where for so long he was the leading figure, we recall with gratitude his gifts and his achievements.

The opening years of this century will be remembered as those in which American surgery as a science and as an art made its full advance into the front rank of world medicine. Prominent among the names in that band of gifted men, who put surgery in America on the sure and safe footing which it enjoys today, will be that of J. B. Murphy in whose unique personality enterprise and enthusiasm were so happily and so effectively combined. Murphy, for many years before his untimely death, had attained to the full stature of a surgeon. Foremost among his many surgical virtues was a true scientific imagination. This, combined with his tremendous concentration on the subject in hand, led to his many remarkable contributions to surgical knowledge. He saw things clearly and had the power of presenting them in vivid relief, so that by convincing argument he led on to conclusions which seemed inevitable and irresistible. He will always be remembered as the foremost among clinical teachers and chiefly because of the fact, that while no man could equal him in the intensity of his focused attention on the individual case, few, if any, could surpass him in drawing the moral and laying bare the underlying principles which the case displayed. About Murphy there was nothing small or parochial; he was a world teacher and an idealist. In the inauguration of this great Clinical Congress and the founding of the American College of Surgeons he played a leading part, and tonight it is especially appropriate that we should remember him at home as a founder of our College in the city of which he was so honored a citizen and surgeon.

American surgery has for many years had an outstanding characteristic: it has been catholic in its grasp, international in its basis. In the search for fresh knowledge, the acquisition of new methods or technique by first hand observation at the source, Murphy by precept and by practice led the way. The international exchange of ideas which he fostered is now one of the most valuable and wholesome features of our profession, promoting as it does not only a high general standard of efficiency, but that mutual understanding and

[1]The John B. Murphy Oration in Surgery, delivered at the Clinical Congress of the American College of Surgeons, at Chicago, October 14, 1929.

friendship which make for peace among the nations.

It is a peculiar honor to deliver the Oration in his memory. That you should have asked a surgeon from Scotland is evidence of the bond which unites our profession in every land, and the special ties which bind my homeland to your great country. That you chose a surgeon from Edinburgh was a graceful tribute to the long-standing and fruitful connection of the great University which I represent with American medicine. When we recall that John Morgan, the pioneer of medical education in America, studied in Edinburgh; that William Shippen, who with Morgan started the first medical school in America, was a graduate of Edinburgh in 1761; that Philip Syng Physick, the father of American surgery, took his M.D. at Edinburgh in 1792; that Benjamin Rush, the most distinguished physician of his day and a name still held in reverence among you, was an Edinburgh graduate in 1768; that Samuel Bard, who started the first medical school in New York in 1769, had taken his degree in Edinburgh but 4 years before; that William Gibson, the founder of the University of Maryland, was a pupil of Sir Charles Bell and an Edinburgh graduate; that Ephraim MacDowell, that fearless practitioner and pioneer of abdominal surgery, got his idea and inspiration when studying under John Bell in Edinburgh—when we recall these indissoluble bonds which united early American medicine with the Scottish capital, you may truly claim Edinburgh as your Alma Mater and I am proud as her representative to be among you today.

In choosing a subject for this address, I was influenced by the fact that, while Murphy in his eager course roamed over the whole field of surgery, his earlier, and perhaps his most valuable contributions were in the domain of the abdomen. It will not, therefore, I trust, be altogether unfitting that I should draw your attention to some principles which I believe are fundamental in abdominal surgery. If many of you recognize in what I say the old familiar faces of the well kent facts, you will pardon the re-introduction.

The capacity of the peritoneum and the abdominal viscera to tolerate even gross interference has been fully tested during the past 50 years and has formed the basis and the backbone of modern surgery. So great is that tolerance that we as surgeons are apt to presume on it and to lose that sense of reverence for living tissues which should be a fundamental law in operative surgery. By an elaborate ritual we endeavor to insure that our operations shall be aseptic; but ritual without reverence may be a mockery, and technique associated with trauma will be tolerated less well than much less perfect asepsis but gentle handling. If we had to epitomize our guiding rules in the surgery of the abdomen, I believe that we might correctly do so by stating "no traction, no tension." The primary impression conveyed to the mind at the first sight of the interior of a normal abdomen is the remarkable flaccidity of all the hollow viscera; in quietness and in relaxation lies their strength. When disease or operative measures interfere with this relaxation and introduce tension, trouble and pain result. Our guiding principle thus will be to relieve tension when we find it, and so to plan our operative work that neither during nor after the operation shall tension on the abdominal wall, the viscera, or the mesenteries be present.

The signal advance in our standard of preoperative diagnosis has furnished us with the advantage of being able so to plan our incisions in the abdominal wall that we shall have the freest possible access to the seat of disease without recourse to forcible retraction. While the integrity of the abdominal muscles and their nerves will ever command our respect, adequate access must always be the first consideration in any major abdominal operation. Too small boots beget corns; too small incisions beget complications. If we visualize the tissues as living, delicate cellular structures, we become less and less intrigued with elaborate mechanical appliances, such as powerful self-retaining retractors and mighty crushing clamps, instruments which not only injure directly the patient's tissues, but blunt obliquely the surgeon's sensitivity. Retractors should be used to retain out of the surgeon's way tissues which have been gently pushed aside—too often we have seen them used as if they were weapons.

Fig. 1. Mobilization of the duodenum; division of fascia propria along its outer border.

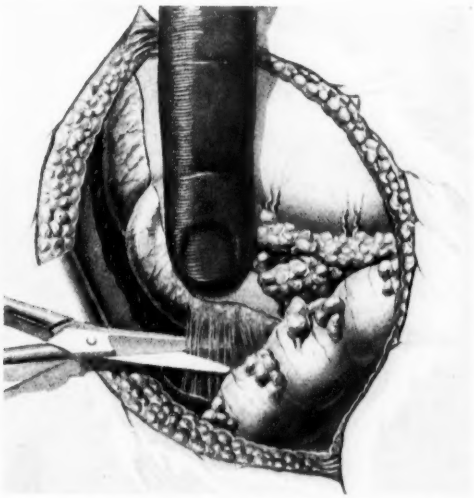

Fig. 2. Division of fascia propria at the angle to insure free mobilization of the duodenum.

THE PRINCIPLE OF DE-TENSION

It is in the effective mobilization of the tissues to be dealt with that our text is best illustrated. Deal only with the mobile organ; if it be immobile, mobilize it. Do it not by force but by strategy based on the anatomical fact that all the abdominal organs were mobile before some became fixed, and therefore all may again be rendered mobile. This sounds dangerously like a platitude, and yet this rule is but imperfectly observed and what should be easy and safe surgery is often rendered difficult for the surgeon and dangerous for the patient.

When William Mayo demonstrated so beautifully how a generous mobilization of the proximal colon might be effected so as to render resection of a large segment both simple and safe, he illustrated a principle which has a widespread application in the abdomen. Other portions of the gut, such as the duodenum, the splenic flexure, and the descending and iliac portions of the colon, are equally susceptible of mobilization. How often can a resection of the transverse or distal parts of the colon be rendered easy by a simple division of the phrenicocolic ligament, enabling tissues, which would otherwise be united under tension, that unforgivable sin in abdominal surgery, to fall together in perfect relaxation. In the mobilization of organs there are two structures to be divided: the peritoneal folds which retain them and the underlying—in the case of diseased organs, usually thickened—extraperitoneal cellular tissue or, as we usually designate it, the "fascia propria." It is the division of this fascial layer which renders the mobilization complete, and this division can best be effected by the knife (Fig. 1). Thus we find, in the mobilization of the duodenum, that a simple division of the peritoneum along its lateral border will free it considerably, but it is only when we divide the fascial bands which hold it, and especially its inferior border, that it can be brought up freely into the abdominal wound (Fig. 2). In the case of the colon the systematic division of the extraperitoneal fascial bands by the knife is of equal advantage.

In one operation above all others, however, is this principle seen to greatest advantage, namely in splenectomy. The greatest impediment to removal of the enlarged spleen is in my experience not inflammatory adhesions, which are rare, but the short outer leaf of the lienorenal ligament. Without an adequate severance of the ligament, the spleen cannot be delivered except at the imminent risk of a tear in the hilum. Not only must the peritoneum

Fig. 3. Mobilization of the spleen. Division of peritoneum and of fascia propria forming the outer leaf of the lienorenal ligament.

on the outer side of the splenic pedicle be divided but also the underlying fascia (Fig. 3). Thereafter a spleen which was apparently fixed, so as almost to defy safe removal, comes forward into a field where easy control of the pedicle is readily secured.

Even when we consider such a simple operation as removal of the vermiform appendix we find that the usual impediment to easy removal is not the presence of inflammatory adhesions but the binding down of the middle third of the organ by that congenital fold first described by Douglas Reid as the genitomesenteric fold. This fold is practically bloodless, and a few touches of the knife will divide it and mobilize the appendix completely, thus allowing it to come up without tension into the abdominal wound (Fig. 4).

MOBILIZATION OF VISCERAL COATS

When a portion of the gastro-intestinal tract is resected, union, whether by end-to-end suture or by lateral anastomosis after closure of the ends, must be effected. When Murphy introduced his button he did a great service to surgery, not only by evolving an ingenious instrument which has stood surgeons in good stead on many occasions when ordinary suture methods were impracticable, but mainly by proving that, if accurate peritoneal apposition was obtained, elaborate layers of suturing were quite unnecessary.

While leak from a suture line may be referable in some cases to sepsis and in others to inadequate blood supply, it is in my opinion usually due to tension either in the long axis of the gut, due to inadequate mobilization, to tension in the suture line, or to postoperative tension within the lumen of the gut. If free mobilization of the ends to be joined has been effected, I believe that in the principle of mobilizing the coats of the viscera to be joined so that the layers may be sutured together without any undue tension lies the secret of safe anastomosis. When we remember that the peritoneal and muscular coats of the hollow viscera offer but a slender hold for sutures and that the strength of the wall in every case lies in the submucous coat, we realize that safe approximation of the outer coats can be accomplished only if carried out with these coats completely relaxed. Such relaxation can be secured, particularly in the colon, only if these coats are first divided down to the submucous layer in each end of the bowel entering into the anastomosis. In the colon it is the longitudinal muscular bands which, being shorter than the rest of the wall, render uniform relaxation difficult. Consequently division of the bands down to the submucous coat should be an essential step in all colon resections (Fig. 5).

The employment of a single layer of interrupted Lembert sutures, lightly tied so as to give the minimum of interference with blood supply, is, I believe, the ideal method of anastomosis, and the safest, if the principle of "de-tension" be fully observed. The use of two or more layers of continuous suture drawn tight must inevitably strangulate a certain part of the sutured margins and the infected slough so formed will in a few cases determine a leak.

The last form of tension to be feared is tension from within. The evolution and retention of gas in the colon during the first few days after operation may bring about tension necrosis at a suture line otherwise perfect. To insure against this, nothing is so efficient as an

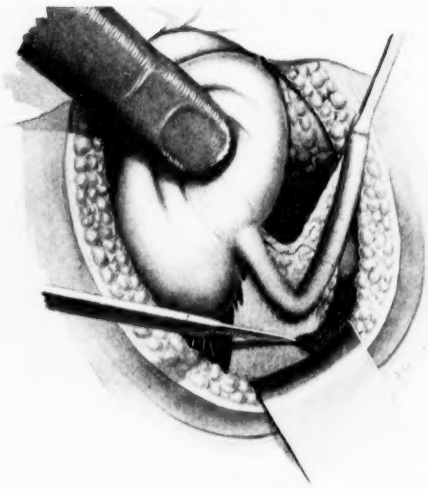

Fig. 4. Division of the genitomesenteric fold—mobilizing the appendix.

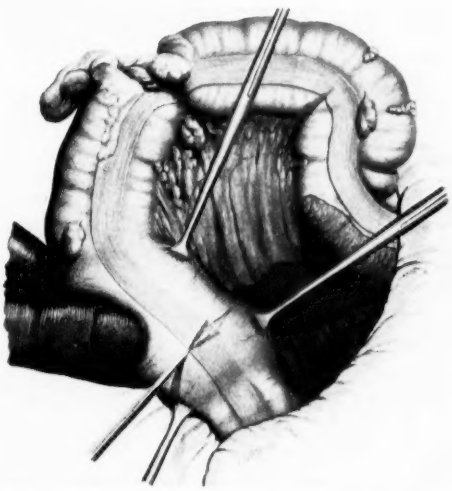

Fig. 5. Division of the longitudinal muscular bands as a step in colon resection.

appendicostomy or, still better, a valvular tube-cæcostomy carried out on the principle of a Senn's gastrostomy. A colon tube passed *per anum* to beyond the anastomosis is less disturbing but hardly so efficient. Insurance against tension from within by a temporary valvular opening may be practiced with advantage when resection of small intestine for acute obstruction is required, and the upper coils are sodden and dilated. Likewise an ileostomy after a resection of the proximal colon, where a subacute obstruction was present, may make the difference between a smooth and a stormy convalescence and may, indeed, be a life-saving measure.

These three elements—mobilization of the viscus, mobilization of its coats, and drainage of its lumen—are best exemplified in a case of resection for a tumor of the descending colon. After free mobilization of the growth has been secured by dividing the peritoneum and fascia propria along the outer side of the distal colon and by cutting the phrenicocolic ligament, the peritoneal and muscular coats are divided round the whole circumference of the gut at the two points chosen for division. Light crushing clamps of the Schoemaker type are then applied at these points and the colon resected. The clamps are then approximated and a posterior row of interrupted fine linen Lembert sutures inserted and tied. An anterior row of similar sutures is now inserted over the clamps which are then removed and the sutures lightly tied, the two ends of intestine coming together without the least tension, and the intramural blood supply suffering a minimum of interruption (Fig. 6). Through an incision in the right iliac region a valvular tube-cæcostomy is now instituted to obviate any gaseous distention. Such an operation, based as it is throughout on the principle of "detension," is followed by singularly little discomfort and in my experience is one of the most satisfactory in the whole field of surgery.

Where, in the case of resection of either small or large intestine, it is deemed wiser to close the cut ends of the bowel and do a lateral anastomosis, the principle of mobilization of coats is still more applicable. A circular incision down to the submucous coat will permit of the application of a catgut ligature and subsequent invagination of a diminutive stump with both rapidity and flaccidity. The cuff method of removing the vermiform appendix is an old and familiar practice. The same method applied to the small and large intestine is sound in principle and easy of performance.

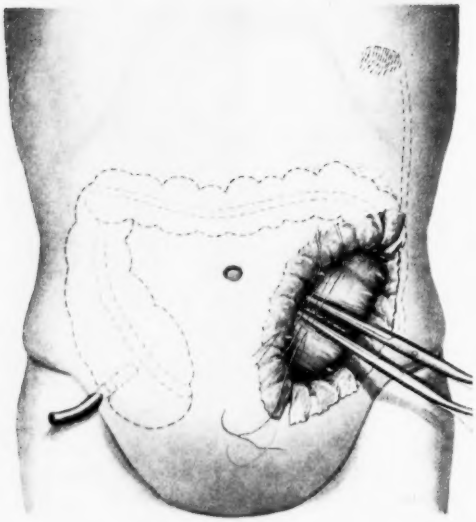

Fig. 6. Resection of the descending colon for malignant growth. Note: Splenic flexure mobilized and brought down; clamps applied to colon after division of the peritoneal and muscular coats; single layer of interrupted silk sutures, posterior row tied, anterior row inserted ready to tie after removal of clamps. Cæcostomy to preclude gaseous distention.

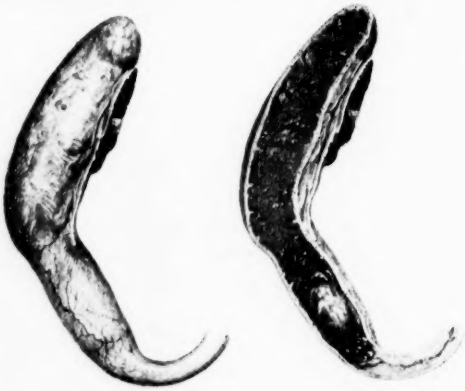

Fig. 7. Acute appendicular obstruction. Gangrene resulting from fæcal retention in the obstructed lumen.

TENSION DUE TO DISEASE

It is a basal fact in clinical observation that most abdominal pains, if we exclude those due to irritation of the parietal peritoneum, are due either to spasm of, or tension in, the hollow viscera. The establishment of a closed cul-de-sac in one of the hollow viscera, if its content be infected by living micro-organisms, is invariably followed by tension. If the content be composed of organic material capable of putrefaction, the ensuing tension will be the more pronounced. Thus we know that the plugging of the neck of an infected gall bladder by a calculus will be followed by an acute distention of the organ by a mucopurulent content, and that the tension may be so great that gangrene of the wall may ensue, particularly in elderly subjects. In such cases an operation which merely opens and drains the gall bladder may be life-saving, however inadequate as a curative measure for the underlying disease. In the case of a strangulated loop of intestine, apart from the danger of obstructed blood supply, we have to reckon that the putrefaction within the closed loop of intestine may in itself lead to such tension that gangrene of the wall may result. The organ, however, in which this factor of tension is found most frequently and with most baneful results is the vermiform appendix (Fig. 7).

No man did more to bring home to the medical profession throughout the world the necessity for prompt and immediate operation in acute appendicular disease than did Murphy. How often and in what arresting language did he proclaim the urgency of early diagnosis and treatment in such disease! In one regard, however, Murphy's teaching on this subject was misleading. He insisted on a rise of temperature as one of the early and cardinal signs of acute appendicular disease. Murphy did not distinguish between the two primary and fundamental pathological processes which occur in the appendix—acute infection of its wall, and acute obstruction of its lumen. In the former a rise of temperature is natural and is invariable; in the latter it is absent during the early phase when diagnosis is all-important. No form of intra-abdominal tension demands our observation and respect so insistently as that of the acutely obstructed appendix, for in dealing with it timely operation can with minimum risk remove threatening danger, while delay inevitably means rupture with peritonitis, oftentimes fatal.

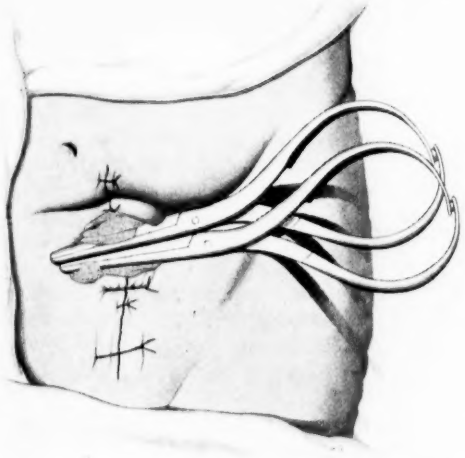

Fig. 8. The on-dwelling clamp method of resection of tumor of the lower part of the pelvic colon.

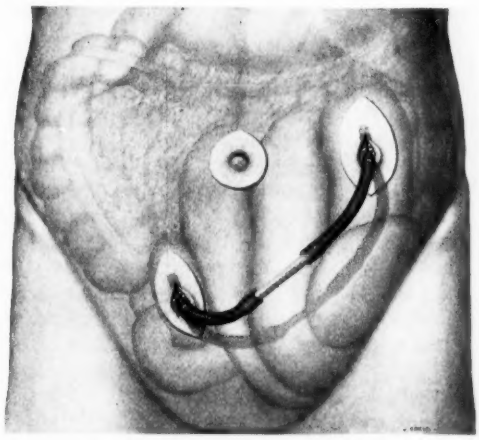

Fig. 9. Shadow sketch of tube anastomosis in high obstruction due to peritonitis.

The death-rate from acute appendicular disease, both in this country and in Britain, has tended to increase rather than to diminish during the past decade. It is my firm conviction that over 90 per cent of the deaths are in cases not of primary inflammation, but of primary obstruction of the appendix with resultant tension, gangrene, and perforation. If we would but visualize this disease as one of the fatal types of acute intestinal obstruction, with the afebrile onset characteristic of such disease, demanding immediate operation before the tense, obstructed organ bursts; if we would teach our students its underlying pathology and demonstrate its characteristic clinical picture—we should not have to deplore a rising death-rate from so-called appendicitis. Van Zwaluwenburg has, I find, been teaching for more than 25 years the fundamental importance of the obstructive factor in acute appendicular disease. While I cannot agree with him that in all cases obstruction precedes infection, I believe wholeheartedly that blocking of the lumen, with tension, is the real danger in appendicular disease.

RELIEF OF TENSION IN ACUTE PERITONITIS

The much discussed problem as to whether drainage of the peritoneum is advantageous and effective in acute, diffuse suppurative peritonitis is to my mind answered by this principle, that, in so far as it relieves tension and permits of improved vascularity, it is helpful. Thus in the case of diffuse peritonitis in which, on the opening of the peritoneum, purulent exudate gushes out, tension has obviously been present and a drain will obviate its recurrence. The fact that the drain is very rapidly shut off by intestinal adhesions is undeniable but by that time it has served its purpose. As Murphy showed very clearly, in cases in which drainage is most required, adhesions around the tube form but slowly. We do well to remember his words, "Reduction of tension must be initial, and the absence of pressure continuous." The tension may, however, prove to be due not to peritoneal exudate but to intestinal distention. In cases in which this factor is pronounced, benefit will result from a cæcostomy or an enterostomy, according to whether the large or small intestine is most affected. Such relief of intra-intestinal tension will, among other influences, render a service to the inflamed peritoneum by permitting of more efficient blood supply. In all cases in which cæcal distention is a salient feature in the operative findings, a temporary valvular tube cæcostomy is invaluable, not only as a safety valve for gas, but as an inlet for fluid to combat dehydration.

THE PRINCIPLE OF COMPLETE ASSESSMENT

In no other region of the body do we find multiple pathological lesions so frequently as in the abdomen. Such multiple lesions may be associated on a common etiological basis or may to all appearances be present by coincidence. An operation which cures one lesion and leaves behind another unrecognized may have all the stigmata of failure and is apt to bring discredit to surgery. It behooves us, therefore, in all abdominal operations, other than those of an emergency character for acute maladies, to be on the lookout for the commonly associated lesions and to exclude other gross pathological changes. I need but refer to the frequently associated lesions in the duodenum, appendix, and gall bladder. It is my belief that all three are dependent on a streptococcal infection and when found together, as they not infrequently are, should each be dealt with, if a completely satisfactory result is to be assured. Within 1 year I met with a malignant stricture in the colon in 3 cases in which operation was undertaken for long-standing gall bladder disease. In one of these, an inadequate exploration failed to reveal the growth, which was recognized only when acute obstruction supervened during the convalescence.

Examples might easily be multiplied of dual lesions present at the time of operation and either recognized or missed, according to whether the assessment of pathology was thorough or incomplete. The two criteria necessary for such complete assessment, if delay and shock are to be avoided, are adequate anæsthesia and generous exposure. It is invaluable for future reference that the negative findings should be recorded. This was a characteristic of Murphy's work, and his constant refrain, "Let the record show," has been perpetuated as one of the most vital and important rules of the Hospital Standardization scheme of the College.

THE PRINCIPLE OF THE TWO-STAGE OPERATION

In the surgery of the abdomen, as in that of many other regions, e.g., the brain, the thyroid, and the prostate, we have learned that it is frequently not only desirable but well-nigh conditional for success, that we proceed by stages to our ultimate operative goal. Many factors combine to make this surgery by stages a necessity. In abdominal maladies, as in few others, the surgeon is often consulted for the first time in the presence of an acute crisis in the disease, e.g., in cases of acute obstruction of the stomach or large intestine, of intense cholæmia in obstructive jaundice, or of walled-off appendicular abscess. The immediate operative indication in any such case is clearly the minimum that will give relief and restore the patient to such condition as will permit of a radical treatment of the causal factor at a later date. The general toxæmia in such cases —the poisoned heart, liver, and kidneys— renders the patient an easy prey to complications if any major procedure is attempted, but, further, the local conditions are thoroughly unsuitable both for operative work and for satisfactory repair. The tissues in and around the affected area are œdematous and friable, the bowel content frequently putrefying and highly infective, and the lymph channels draining the area laden with bacteria. A preliminary operation, whether it be a gastro-enterostomy in a stenosing pyloric carcinoma, a simple choledochostomy in biliary obstruction, a cæcostomy in a large bowel obstruction, or a simple drainage of an appendicular abscess, will give the necessary relief and a respite until toxæmia has passed, nutrition is in a measure restored, the factors of local œdema, tension, infected lymph channels, and vascular stasis eliminated, and tissue calm restored.

It must be realized that no fixed length of interval between the preliminary and radical operation can be laid down, but that each case presents a problem demanding an individual exercise of surgical judgment. Apart altogether from the benefit accruing to the patient from this restorative interval, we know that the mere opening of the abdomen and the handling of the viscera calls forth a reaction which gives to the peritoneum an increased resistance to infection at the second operation. The latter deals with a peritoneum prepared and warned; there has been, as it were, a test mobilization of the protective forces.

While working at the subject of peritonitis 20 years ago with the object of testing whether

a specific local immunity could be produced, I was impressed by the fact that the injection of any material whatsoever into the peritoneal cavity gave within 40 hours a markedly increased resistance to a lethal dose of microorganisms. The material injected did not need to be bacterial; it required to be merely foreign material. The same increase in resistance could be secured by a preliminary opening of the abdomen and handling of the viscera. This called forth an immediate emigration of polymorphonuclear leucocytes but later—and more important—a mobilization from the omentum and mesenteries of large macrophages which could "stand to arms" the moment the infection arrived.

When it happens that a resection of some portion of the large bowel constitutes the second operation, an attempt may with advantage be made further to increase the patient's resistance to the possible infection which awaits him. We know that this infection is usually a mixed one—streptococcal and bacillus coli—and by suitable inoculation we may hope to obtain a certain degree of immunity. Since 1909 it has been my custom in all cases of excision of colon or rectum to give two preliminary injections of streptococcus and bacillus coli vaccine, the first given 10 days, the second 3 days before operation, and to combine this with an injection of nucleic acid given 12 hours before the operation, the latter to call forth a leucocytosis. Experimentally I had found that this preliminary treatment gave in animals a definite increase of resistance to peritoneal infection and I have reason to believe that it has a real value in human surgery. Recently at The Mayo Clinic intraperitoneal injections of vaccine, with the same object in view, have given encouraging results.

In referring to two-stage operations, one must not omit to mention the Mikulicz-Paul operation of eventration of the growth in obstructing tumor of the colon. The advantages of this method of dealing with stenosing carcinoma of the pelvic colon in old and feeble subjects are well known. While this practice is tedious, it is eminently safe, especially if an interval of some months be allowed to elapse before an attempt is made to close the artificial anus.

The on-dwelling clamp operation, a modification of the Mikulicz-Paul method, has proved of great value in dealing with large growths in the lower half of the pelvic colon, especially in cases in which multiple resections of intestine were required. In this class of case when, after resection, the lower stump of the pelvic colon reaches just up to the pelvic brim, an end-to-end anastomosis is difficult of performance and the blood supply of the lower end is precarious. By applying clamps with heavy handles to both ends of the colon, fixing the latter in apposition for 1 inch by interrupted sutures, fixing the clamped ends in the abdominal wound (Fig. 8), removing the upper clamp in 2 days and leaving the lower one to slough off, one has repeatedly been able to deal successfully with tumors which appeared well-nigh inoperable. In several cases the lower stump has sloughed for an inch below the clamp but without untoward result. After the application of an enterotome, an interval of 2 months is allowed to elapse. This interval permits retraction of the ends of the colon, a return of the tissues of the abdominal wall to normal suppleness and elasticity and, most important of all, an immense betterment in the general condition of the patient.

THE PRINCIPLE OF REPLENISHING PHYSIOLOGICAL LACK

The cause of death in high intestinal obstruction is a subject which has attracted the intensive interest both of practical surgeons and laboratory workers. Gradually the factors which are operative in producing the condition of collapse, so characteristic of this type of obstruction, have been elucidated and, while much remains to be cleared up, we have today in our possession a number of facts which point the way to ultimate solution of this difficult problem. While possibly a chemical substance of albumose type is absorbed from the distended bowel above the obstruction, and while drainage of this obstructed gut will give some relief, we know that death may yet ensue when free drainage is established. The pronounced dehydration which accompanies such obstruction and the call of the tissues for fluid are now recognized to be of

primary importance, and replenishment of body fluids the first indication in treatment. The very important fact that a notable and dangerous loss of chlorides occurs in such cases has led to the use of hypertonic saline injections with marked improvement in results. The aspect which I wish to emphasize, however, is that of the deprivation of the bowel below the obstruction of the secretions which should normally descend into it from the upper portion.

We know that in animal experiments high obstruction with immediate drainage of the bowel is not survived for very much longer than an obstruction without drainage. The fluid, which in the bowel above the obstruction may appear to be toxic and threatening the patient's life, may be life-saving if it is introduced into the bowel below the obstruction.

This fact was first borne in on me by a case of postoperative obstruction following acute appendicitis which is recorded in the *British Journal of Surgery* (Vol. xi, No. 43, 1924), but to which I venture to refer again here. In this case an enterostomy was performed, but the coil opened was evidently below the really active obstruction, for no flow from the tube resulted. Later, on the same day, a second enterostomy was performed, this time on the highest jejunal coil, and a profuse discharge followed. In spite of copious saline infusion the patient continued to go downhill until the device of joining up the two enterostomy tubes was practiced when the abundant secretions from above the obstruction were conducted through the joined tubes to the intestine below (Fig. 9). An immediate and remarkable improvement followed this maneuver, the patient made a satisfactory recovery, and he is alive and well today.

This call of deprivation of the empty intestine below in cases of high obstruction constitutes I believe, an important principle in the treatment of such cases. Brockman has emphasized the benefit of enemata of bile in postoperative ileus, and has shown the important rôle which the absorption of bile from the lower reaches of the bowel has in liver function. There are, I believe, other factors besides bile in the profound physiological upset which results when an obstruction occurs between the active secretory upper part of the small intestine and the absorptive reaches below. The emptying of the upper distended coils, at operation for acute obstruction of the small intestine, say from a band, may, by reducing intra-abdominal tension, permit of more vigorous peristalsis thereafter and thus be an advantage. It will not save the patient's life, however, unless subsequent peristalsis results in the propulsion of the content of the higher coils into the empty coils below. The conception of a physiological lack below, combined with a pathological retention above, is one which deserves our attention and will find a field for application in our practice.

In submitting to your notice these principles of de-tension in operating, of intravisceral tension in disease, of complete assessment, of the two-stage operation, and of the supply of a physiological lack in obstruction—I feel that I have made a very inadequate contribution to the list of communications delivered in memory of a great man. I am comforted in this, however, that in my endeavor I was guided by the spirit of Murphy in seeking from my own experience to find principles which had a wide application in practice, and in the assurance that in the commonplace we may sometimes find the most valuable guiding lights for our daily work.

HYPERTHYROIDISM ASSOCIATED WITH CARDIAC DISORDERS[1]

FRANK H. LAHEY, M.D., F.A.C.S., BOSTON

A FEW years ago we directed attention to a group of cases of hyperthyroidism with auricular fibrillation and cardiac decompensation and another group with auricular fibrillation alone. The latter group was one of potential heart failure. In the former group, the underlying hyperthyroidism, as being the cause of heart failure, had in a considerable measure been overlooked. The degree to which cardiac capacity could be regained following the removal of the toxic goiter had not been anticipated nor was the relative safety with which these apparently inoperable patients would withstand a general anæsthetic and subtotal thyroidectomy realized.

For the purpose of marking them as an entity and thus directing attention to them so that they would be removed from a group of patients considered hopeless and, as proved by our experience with them, converted to a group in which the most amazing results in thyroid surgery (restoration of cardiac capacity after seemingly hopeless decompensation) could be obtained, we designated them under the perhaps inaccurate but descriptive term "thyrocardiacs."

It has been assumed for a long time—and by some it is still considered to be true—that the effect of hyperthyroidism is a destructive one upon the heart. Upon this assumption, it is sometimes presumed that there is a state which may properly be called "a thyroid heart." For several years I have believed and written that this is not so and that hyperthyroidism in itself accomplishes no destructive effect upon the heart which can be distinguished either microscopically or by the interpretation of clinical findings. Furthermore, there is no laboratory evidence to bear out the idea that the effect of hyperthyroidism is to produce permanent myocardial changes. We have, with our increasing experience in the pre-operative and postoperative observation of thyroid cases, now amounting to well over 7,500, been more and more convinced that hyperthyroidism in itself does not directly produce degenerative changes in the heart. In association with Dr. B. E. Hamilton, to whom we are indebted for assistance early in our experience with the thyrocardiac, and now with Dr. L. M. Hurxthal, we have seen several young and middle-aged people die either without operation in the acute crises of hyperthyroidism or in the acute postoperative or so-called thyroid storms. No matter how great the intoxication, regardless of the uncountable rates to which the pulse rose, there was none of the clinical indications of failing compensation. The patients were not orthopnœic, they could lie flat without embarrassment, there was no œdema and there was no enlargement of the liver. We have further observed after operation a very large series of patients who, without previous heart damage, have suffered the effects of hyperthyroidism over long periods of time and in whom relief of hyperthyroidism with restoration of the cardiac rate to normal range has resulted in a heart which is as capable as one which has never been subjected to the effects of hyperthyroidism. This does not mean that there are no patients in whom relief is not complete, but that, in those patients without previously existing heart damage where the relief from hyperthyroidism is complete, no permanently damaging effects of the hyperthyroidism are recognized in the heart. In all patients dying of hyperthyroidism, we have also sought by autopsy to demonstrate effects upon the heart which might be considered the results of prolonged hyperthyroidism, but we have not been able to recognize any.

It has always been our belief, and one which is shared by Dr. Hurxthal, who has had the opportunity of observing a large number of thyrocardiacs in the Lahey Clinic from a medical viewpoint, that cardiac decompensation, associated with thyroidism, is due to the effect of thyroidism upon a previously damaged heart rather than the damaging effect of thyroidism upon the heart. The relative infrequency with which cardiac complications occur

[1] Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

in young people and their frequent appearance in patients in late middle and the later years of life, when sufficient time has elapsed to acquire cardiac damage, lends weight to the probability of this assumption.

This hypothesis also permits a reasonable explanation of the operability, the degree to which the patient may be relieved of his cardiac decompensation, and the remarkable capacity for sustained effort which he or she can regain following the relief from hyperthyroidism. These conditions, under which the factor causing the heart failure to appear and persist can be removed surgically, have no parallel in heart conditions.

There are several factors which are responsible for the ease with which underlying hyperthyroidism as a causative factor in cardiac failure has been so often overlooked. One is that the urgent and most evident portion of the picture of cardiac failure due to hyperthyroidism is the cardiac failure, the distressing orthopnœa, the œdema, and at times the ascites and general anasarca. Another factor is that the underlying heart disease may be correctly diagnosed by the internist, because of a history of rheumatic infection and the finding of valvular lesions, yet hyperthyroidism as the precipitating cause be overlooked.

These features particularly direct one's attention to this pressing side of the picture, especially when it is realized that the evidences of hyperthyroidism, when associated with heart failure at the age period in which it so frequently occurs, are usually far from typical in comparison to the features of the disease in a young and active person without associated cardiac damage. Furthermore, in the primary or exophthalmic type of hyperthyroidism, the thyroid gland is not only without enlargement, but is often not of sufficient size even to be visible and, to add further difficulty to the diagnosis, the hyperthyroidism often associated with cardiac decompensation evidences itself, not by the striking and typical activation of hyperthyroidism as seen in young and active individuals, but rather by a form of hyperthyroidism characterized by apathy in contrast to activation.

In a recent paper on the thyrocardiac, the subject of the apathetic type of hyperthyroidism was discussed at some length, but, at the risk of repetition, I would like to stress the necessity of understanding the seriousness of the non-activating type of hyperthyroidism which is so commonly found in thyrocardiacs and which we have frequently written about under the term "apathetic hyperthyroidism."

Everyone is familiar with and cannot fail to be impressed with the apparent seriousness of the activating type of hyperthyroidism which is observed particularly in young and vigorous individuals. The bounding, rapid pulse, often of startling rates, the pounding heart action, the flushed face, the constant agitation impress upon one, almost beyond possible error, that here is a serious and dangerous situation. On the other hand, however, is the other type of hyperthyroidism, less well known, less typical, very much less striking, about which little has been written, but which possesses the most serious possibilities of fatal outcome. It is characterized by non-activation, by only moderate elevations of pulse rate and by pulses of not particularly bounding quality. This is the apathetic type of hyperthyroidism and is often the cause in itself of failure to recognize this type as the underlying cause of heart failure. It is this type of hyperthyroidism, unassociated with cardiac states, which leads one to do, unjustifiably, extensive operations upon the thyroid. Many patients with hyperthyroidism of this kind maintain very reasonable pulse rates during operative procedures, which fact, associated with lack of activation, leads one to do complete thyroidectomies, only to have the patients die after operation by progressing into the deepening state of apathy, finally to succumb in peaceful unconsciousness as opposed to the wild excitation of a thyroid storm. These are the cases in which it is so difficult to estimate pre-operatively the capacity to withstand operative procedures, and just as apathetic thyroidism must be carefully looked for in cardiac decompensation suspected to be due to a possible underlying thyroidism, so it must be balanced as to the extent of operability in thyroidism of the apathetic type unassociated with cardiac decompensation.

We have repeatedly stated that the operability of patients with cardiac decompensation due to associated hyperthyroidism, as

proved by our own experience, is far greater than used to be thought possible. We have definitely proved that many, if not most, of the thyrocardiacs in severe decompensation who were in the past rejected as inoperable, are today not only operable but operable with only a reasonable mortality. Up to about 2 years ago, we had operated upon 138 thyrocardiacs and have since been able to ascertain, chiefly by examination, the exact status of most of them. The operative mortality in this group of 138 was 3.6 per cent, 5 having died. Of those dying after operation while still in the hospital, 1 death was from postoperative mediastinitis following the removal of a toxic retrotracheal adenoma in a patient with severe decompensation; 1 from status lymphaticus (autopsy finding); 1 from pulmonary embolus; and 2 were sudden, from unknown causes (no autopsy). Within the past 2 years the operative mortality has been materially reduced. This group represents one in which there were no rejections on account of decompensation.

We have operated upon all but 4 patients of the thyrocardiacs who have come into our hands. Operation was not done in these cases for the following reasons: 1 died of bronchopneumonia before operation could be done; 1 toxic patient had, in addition, hopeless malignancy; 1 patient died of tracheal obstruction before operation; and 1 patient refused operation.

When one realizes that some of these patients were so breathless that they had not been able to lie flat for weeks, had general anasarca, and a few could not be relieved of their decompensation by any measures then available, and yet withstood a general anæsthetic (ethylene) and a subtotal thyroidectomy, within a few days regained their compensation, and within a few weeks could walk out of the hospital, one realizes that there are no patients too badly decompensated to be rejected and to be able to regain their compensation to such a degree as to be up and about in a reasonably active capacity.

We do not make this statement, that we have rejected practically no patients because of the degree of their decompensation or that there are no patients with cardiac decompensation due to hyperthyroidism too ill for operation, with any spirit of assertive pride, but rather with the idea that it will prevent seemingly hopeless patients with this condition from being denied the possibility of relief and, thereby, a lengthened and useful life.

An explanation of the ability of some thyrocardiacs to withstand a general anæsthetic and subtotal thyroidectomy with a surprisingly low mortality rate is doubtless the fact that any patient with cardiac decompensation and thyroidism who is able to get to the hospital and to stay alive there long enough to have the matter of operation considered, must necessarily possess a considerable degree of cardiac reserve. Often one of the features of the cardiac decompensation associated with hyperthyroidism is that, because of the underlying hyperthyroidism, it has been impossible, with rest and appropriate medical measures, to restore compensation. Nevertheless, those patients who reach the hospital usually do not become progressively worse while resting and under observation. Every patient, therefore, with a cardiac decompensation which persists in spite of seemingly adequate therapeutic measures, should be carefully investigated as to the possible presence of a hyperthyroidism as the causative factor in the decompensation; and, furthermore, every case of auricular fibrillation must be thought of in terms of a possible hyperthyroidism, just as hyperthyroidism must be considered as the possible cause of every glycosuria.

So difficult may be the diagnosis of this possible underlying hyperthyroidism that often but doubtful evidence of it is present, such as: moderate exophthalmos or stare; pigmentation; a firm, hard, but not enlarged gland; unexplained weight loss, particularly in spite of good food intake. Any person, therefore, with goiter and heart failure or auricular fibrillation should be suspected of hyperthyroidism, because of the hope which surgery may hold out to him, in contrast to the patient suffering from decompensation incited by causes other then hyperthyroidism.

Auricular fibrillation is definitely associated with hyperthyroidism in patients past middle age and is also a causative and promoting factor in cardiac decompensation due to hyperthyroidism. While the relief of hyperthyroidism results in restoration of normal rhythm in

many instances, and is particularly successful in the treatment of transient auricular fibrillation, it is not the purpose of this discussion to dwell particularly upon this cardiac complication of hyperthyroidism. This phase of the subject has been reported upon from the Clinic by Dr. L. M. Hurxthal. It is now so generally accepted that permanent or transient fibrillation is no contra-indication to partial thyroidectomy that the subject does not need to be considered further here. We have learned from our experience with cardiac decompensation due to hyperthyroidism that every measure which will in any way lessen decompensation pre-operatively should be employed in these cases. We have kept them in bed at rest as long as it was apparent that any degree of relief of decompensation was being obtained. Dr. Hurxthal has employed digitalis only in two types of cases—those with congestive failure who did not improve with iodine and rest in bed, and those patients with established auricular fibrillation in whom an excessively rapid pulse rate persisted after a reasonable time in the hospital. Although in the congestive failure cases digitalis may slow the pulse, banish dyspnœa and orthopnœa, and at times promote a diuresis, diuretics (theosin and salyrgran) are frequently employed with excellent results. Fluids are restricted until time of operation, but can be given freely after operation. In the established fibrillation group, digitalis renders a slower and less alarming pulse rate throughout anæsthesia and is a safe brake on the heart for any postoperative complication which might precipitate an added load on the circulatory apparatus.

Quinidine is reserved for auricular fibrillation until after operation because of its apparent greater toxicity in the thyrotoxic patient and because of the liability of the recurrence of auricular fibrillation immediately after or during operation. The percentage of return to normal rhythm following operation has been increased from 52 per cent without quinidine, to 76 per cent with quinidine.

In the beginning of our operative experience with patients having cardiac decompensation and thyroidism, we believed that it was necessary to do the partial thyroidectomy with local anæsthesia. We have for the last 3 years employed ethylene in all operations upon thyrocardiacs, except those with dangerously elevated blood pressure. Ethylene with its high mixture of oxygen has proved just as safe as, and far more comfortable than, a local anæsthetic for these patients. Dr. Hurxthal, in whose hands rests the management of the heart conditions in these patients, has called our attention to the desirability of anæsthetizing and operating upon the more serious cases in the upright position—a very wise suggestion. If it is difficult for decompensated patients to breathe while conscious in the reclining position, it is probably an added cardiac burden for them to be anæsthetized and operated upon in that position.

We have found it most desirable to do complete subtotal thyroidectomy on thyrocardiacs with decompensation, since relief from decompensation is most likely to be obtained with the greatest degree of relief from thyroidism. While a complete one-stage partial thyroidectomy is to be desired, it cannot always be accomplished with justifiable prospects of toleration by the patient. In such a case we have divided the operation into two stages, a right first stage subtotal hemithyroidectomy and a later left second stage subtotal thyroidectomy. It is extremely important, even though the right first stage subtotal thyroidectomy accomplishes relief of decompensation, that the patients should be kept in the hospital under supervision and treatment until ready for their second stage procedure. We have found this necessary because of the fact that we have permitted patients to return home between stages when relieved of decompensation by the first stage procedure, only to have them return to us again in decompensation because of undue exertion, intercurrent infection, and, in one case, an alcoholic excess. Because of those experiences, we urge that patients be kept under observation until relieved to the greatest possible degree of their thyroidism.

A study of the end-results, as reported in a recent communication on this subject, involved the investigation of 142 patients who might be classified as thyrocardiacs. Of this number 18 are untraced and the outcome in only 124 is known. Five died operative

deaths while still in the hospital, an operative mortality of 3.6 per cent. The types of death were given earlier in this paper. Fourteen have died since operation. Of this number 4 died with congestive heart failure, 3 died sudden deaths, 1 died of pneumonia, and 4 died of undetermined causes. Two other cases died of causes other than heart failure after leaving the hospital. Four were not operated upon, for reasons enumerated in the earlier part of my remarks. One hundred and one cases are alive and their condition known.

Of the 101 thyrocardiacs operated upon and now alive, 76 have full return of the function enjoyed before the onset of hyperthyroidism, 19 have persistent auricular fibrillation, 4 are partially disabled, and 9 are completely disabled.

The average duration of cardiac symptoms before operation as given by the histories in these studies when obtained was 2½ years. The average number of years during which the 101 patients who are alive after operation have now been well and active in the degrees above stated is 3½ years.

The age incidence is grouped below:

Age	No. of cases
20 to 29	1
30 to 39	17
40 to 49	37
50 to 59	56
60 to 69	27
70 to 75	4
Total	142

The incidence of established auricular fibrillation in the 142 cases before operation was as follows:

Established auricular fibrillation (85.4%)	122
Paroxysmal tachycardia (1.4%)	2
Normal rhythm (12.6%)	18
Auricular fibrillation with clear cut congestive failure	92
Normal rhythm with congestive failure	18
Auricular fibrillation without clear cut congestive failure	30
Paroxysmal tachycardia with congestive failure	1
Paroxysmal tachycardia without congestive failure.	1

If we throw out all except the clear cut failures, 30 cases, we may group under mild failure 55 cases, those patients having œdema and marked dyspnœa on attempted activity; under moderate failure, 14 cases, those having œdema, enlarged liver, and orthopnœa and requiring rest in bed and active treatment; and under severe failure, 42 cases, those with anasarca, hydrothorax, large liver, orthopnœa, and dyspnœa at rest and requiring intensive medical treatment.

Of this entire group of cases operated upon, 49 were adenomatous goiter with secondary hyperthyroidism, and 93 were exophthalmic goiter or primary hyperthyroidism, indicating that toxic adenomata are no more apt to produce cardiac complications than is primary hyperthyroidism or exophthalmic goiter. The incidence of type of thyroidism corresponds in these figures to the incidence of type of the disease as it occurs in our community.

CONCLUSIONS

It is therefore concluded that:

1. Thyroidism in itself does not by its direct action upon the heart produce destructive changes in the heart.

2. The thyroidism frequently associated with cardiac decompensation is atypical and of the apathetic type.

3. Thyroidism of the apathetic type is less striking and much more dangerous than thyroidism of the activating type.

4. There are practically no cases of cardiac decompensation due to associated thyroidism which cannot be submitted to surgery with only a reasonable risk.

5. The possibility of restoration of cardiac capacity after removal of the associated thyroidism in thyrocardiacs is extraordinary.

6. Toxic adenomata are no more apt to cause cardiac failure than is primary hyperthyroidism or exophthalmic goiter.

Suggestions as to the handling of these cases are made upon the basis of our experience with them. To substantiate the above conclusions, an end-result report on 142 thyrocardiacs is submitted.

DISCUSSION

DR. H. M. RICHTER, Chicago: Dr. Lahey and his associates have done much to focus attention on the frequent etiological relationship of thyrotoxicosis to heart disease. Five years ago Hamilton presented a splendid piece of work on this subject from the Lahey Clinic before the American Medical

Association, in which he called attention to the frequency with which this thyroid background is overlooked. The clinical effect of hyperthyroidism on the heart is common knowledge. "Hyperthyroidism masked as heart disease," to quote a phrase coined by S. A. Levine of Peter Bent Brigham Hospital, is still unsuspected by too many internists of the first rank, and is almost entirely unknown to the general practitioner.

My experience with the association of thyrotoxicosis and heart disease has been along parallel lines to that of Dr. Lahey though on a much smaller scale. My observations of the more detailed cardiac damage have been less complete. The internists associated with me have repeatedly seen the manifest effect of detoxication by thyroidectomy on the damaged heart but they rather than I have interpreted in more exact terms the significance of the pre-operative cardiac manifestations and the change wrought by operation.

Serious cardiac damage has presented itself in my material mainly in older patients. In a group of 55 advanced cardiac cases picked from a consecutive series of 1,000 patients subjected to thyroidectomy, 37, or 68 per cent, were over 50 years of age; whereas, of the entire 1,000, only 20 per cent were over 50 years of age. One must differentiate between patients who exhibit unrelated cardiac changes upon which thyrotoxicosis has been superimposed and the true thyrocardiacs. We cannot expect to relieve the former group of their organic damage. It has been my impression that thyrotoxicosis in the aged tends particularly to damage a heart handicapped by earlier organic changes. Autopsy findings have commonly failed to show extensive gross changes or specific changes. That thyrotoxicosis has a selective action on a previously damaged heart and leaves the normal heart of the younger patient relatively unharmed would be difficult to prove. More exact histological methods show enough cardiac damage to suggest that long continued thyrotoxicosis may leave serious permanent injury. The group here considered was composed of constant or intermittent fibrillators at the time of operation. Forty-three ceased fibrillation before their discharge from the hospital.

Cardiac decompensation, like fibrillation, yielded in great measure to adequate iodine therapy and thyroidectomy. Some of these patients with an unrecognized thyroid basis had been resistant to persistent treatment along recognized lines for cardiac disease, only to respond promptly to thyroidectomy. It is significant that the more serious cardiac damage was usually associated with unrecognized thyrotoxicosis of long standing. The ultimate results, as contrasted with the immediate improvement, have been less satisfactory. Restoration of compensation has not always been permanent. In cases of organic heart disease, high blood pressure, and fibrillation, the usual sequelæ must be anticipated in spite of complete relief of the thyrotoxicosis, high blood pressure in particular causing disappointment in its failure to yield to thyroidectomy.

This group as a whole presented much less obvious increased excitability, though it included a few patients showing high-grade mental disturbances. Eye changes were relatively infrequent. Tachycardia was far less constant than in the younger patients with acute hyperthyroidism.

Weight loss and elevation of metabolism were almost universal. The average pre-operative metabolism of these 55 patients was plus 57; 33 or 60 per cent averaged plus 72; 13 or 24 per cent averaged more than plus 80. Yet one had a consistently low metabolism repeatedly falling to within normal.

In the absence of a rounded out thyroid picture, the most important diagnostic criteria have been, in the order of their importance, a raised basal metabolic rate which alone, in the absence of obvious reasons for its existence, justifies the diagnosis; the response of the patient to full therapeutic doses of iodine; weight loss; physical weakness; and tremor. I have seen no case in which either cardiac disease or high blood pressure, not associated with hyperthyroidism, has been associated with a substantially raised metabolism.

The use of full doses of iodine as a therapeutic test of thyrotoxicosis ranks in value with the therapeutic test for syphilis in pre-Wassermann days. The clinical effect, rather than the effect on metabolism alone, determines the diagnosis. Cardiac irregularity in questionable cases is always strongly presumptive of thyrotoxicosis.

Finally, I subscribe whole-heartedly to Dr. Lahey's attitude toward the surgical treatment of the thyrocardiac. These patients respond to properly directed preparatory treatment. The mortality in these cardiac cases has been reduced to the level of that of general abdominal surgery.

In my own work, iodine has been the mainstay in preparatory treatment. Radiotherapy is not used. Prolonged bed rest, or other form of delay, is objectionable. The duration of the iodine preparation in the cardiac group has ranged around 4 weeks.

Thyroidectomy detoxicates the patient. It meets the requirement of James Mackenzie who in speaking of the "poisoned heart" of any variety said, "The appropriate treatment is to get rid of the poison. Simple as this proposition seems, yet it is wonderful to find how often it is neglected, or, if not neglected, how attempts are made to cure the heart condition as if it were something apart from the intoxication." This criticism of Mackenzie's clearly applies to the treatment of the thyrocardiac patient by any method short of adequate thyroidectomy.

DR. O. E. NADEAU, Chicago: Anyone with the clinical experience, the judgment, and the ability to analyze his work, no matter in what phase of medicine, possessed by Dr. Frank Lahey, must be judged an authority, and so it is with Dr. Lahey on the subject of goiter in its various manifestations.

While it may be true that the cardiac conditions seen in goiter are not proved to be those of definite

degeneration or inflammation of heart muscle, still the interrelation between the two is so definite and so relatively constant that we must consider thyrocardiac disease a definite entity. Therefore, even despite Dr. Lahey's arguments, we may say, for purposes of this discussion, that goiter does produce cardiac and circulatory pathology and must take a more important place in the cause of heart disease than it has been considered to do in the past.

To illustrate why we believe goiter not to be sufficiently stressed in the consideration of the causes of heart disease, I shall cite a few references from the literature: (1) Sir James Mackenzie, in the *Oxford System of Medicine*, makes no mention of goiter as a factor in heart disease. (2) Alexander Lambert, in Tice's *System of Medicine*, states that the nervous excitability and hypertension accompanying goiter *may* have an influence in producing cardiac disease. (3) Paul White, of Boston, in Nelson's *Loose Leaf Medicine* published in May of 1929, states that 2.9 per cent of 2,421 cases of organic heart disease were associated with, but not necessarily caused by, hyperthyroidism. (4) Myers and Peck, in Iowa, found 1.5 per cent of 264 organic heart cases probably due to goiter. (5) Vasquez Laidlow mentions Graves' disease only in the etiology of tachycardia.

It is, of course, evident that the importance of goiter as a cause of heart disease must vary with the geographical location of the cases studied. Therefore, statistics from the southern states, for instance, would show very few cases of heart disease due to goiter because there are so few goiters. However, in a locality such as the Great Lakes drainage district, the incidence of heart cases aggravated by goiter must be much higher.

Another factor is that of the insufficient recognition by the profession in general of the correlation between the heart and the goiter. It is undoubtedly true that many cases of heart disease are seen in which thyroid disease is also present in the same patient, but in which the interrelation of the two is not recognized until late in the course when a history of thyrotoxic crisis is obtained.

Is there any difference between exophthalmic goiter and toxic adenoma? We believe that they are the same disease and that the only difference is the chronicity or stage. In other words, exophthalmic goiter is an acute hyperthyroidism, toxic adenoma being a chronic form of the same disease. A study of many specimens, gross and microscopic, of removed thyroid glands will convince one that the pathological anatomy of toxic adenoma is practically identical with that of exophthalmic goiter. What does this mean? To my mind it can be answered only by a thought that with each light attack of exophthalmic goiter in the chronic cases there is left a small island of hyperplasia which eventually continues to grow, thus forming an adenoma. These adenomata then degenerate into the various forms seen in cases of toxic adenoma, such as cysts and calcareous masses.

Although the cause or causes of goiter are not known at the present time, it would seem that the factors producing the clinical entities of acute hyperthyroidism and chronic hyperthyroidism are the same that cause cardiac decompensation both in cases of exophthalmic goiter and so-called toxic adenoma of the thyroid gland.

In order to obtain information in the Percy Clinic at the Augustana Hospital about the incidence of heart disease in goiter, we reviewed 1,509 cases of goiter operated upon between September 1, 1927, and September 1, 1929. Of these cases we considered 28.3 per cent to be thyrocardiacs. They do not include cases of simple tachycardia or other mild symptoms of hyperthyroidism but only those cases in which it seemed evident that there was some form of actual cardiac disease. Of the total number of cases, 8.4 per cent had auriculo-fibrillation. The postoperative mortality rate was 1.8 per cent, two-thirds of which was due to heart failure. A systolic blood pressure of 160 mm. or over was present in 18.2 per cent of the cases, which figure is to be compared with other statistics in the frequency of hypertension in thyroid disease.

Heart disease of this type, as Dr. Lahey has told us, is therefore preventable, and there is nothing so striking in the treatment of any disease as the relief of symptoms in a case of cardiac manifestations due to goiter. A thyroidectomy produces such rapid and often permanently beneficial results that no case of goiter with even the earliest of cardiac signs should go without treatment. It is, of course, essential that such patients should be treated very early in their course to prevent any permanent damage to the heart muscle which might preclude the perfect recovery expected in an early case well treated.

In conclusion, we may state:

1. Cardiac disease due to goiter is largely preventable and much can be done to educate the public in the benefit of early treatment.

2. Goiter as a cause of heart disease has not received sufficient attention in those geographical areas where the incidence of goiter is high.

3. Although the causes of goiter are not known, it would seem that exophthalmic goiter is an acute phase, and toxic adenoma a chronic phase, of the same disease.

THE DANGERS INVOLVED IN THE OPERATION OF THORACOPLASTY FOR PULMONARY TUBERCULOSIS[1]

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THE operation of extrapleural thoracoplasty for certain forms of pulmonary tuberculosis, born in 1908, has in this year reached its majority, and one may say unhesitatingly that it has deservedly acquired full rights of citizenship. It found first a wide acceptance in Germany, Switzerland, and Scandinavia, in which countries the number of operations performed must now amount to several thousand. In England and France, where medical opinion is apt to be more conservative, the operation was taken up rather later, and the same is true of this continent. However, although we on this side of the water, with two or three exceptions, allowed some 10 or 15 years to elapse before we realized the very great value of the procedure, our usual enthusiasm for the new thing, stimulated as it soon was by early successes, has rapidly grown. At present throughout the country the operation is being done, and done sometimes by men who are insufficiently educated in the fundamentals of tuberculosis, and who are apt to regard the operation only from the standpoint of surgical technique.

Up to 1914 only 3 thoracoplasties had been performed on this continent. In 1919 the writer reported a series of 12. Over 3 years ago a questionnaire sent out to all those who were engaged in this work showed that at that time between 300 and 400 thoracoplasties had been done. At the present moment, though I have not accurate figures at my disposal, I feel sure that well over a thousand must have been carried out in this country. Now, from published reports and from numerous conversations, I have reason to believe that this enthusiasm threatens to go beyond proper bounds. Enthusiasm without adequate knowledge becomes a dangerous thing. Nor can knowledge itself escape the same reproach if it be not corrected by that wisdom which comes only from study and reflection. I have the best reason to think, judging from my own experience, that a good many patients have been operated on who should not have been operated on, and that a good many deaths have occurred as the result of rash enthusiasm unsupported by sufficient study, the blame for which lies at the door of the surgeon as well as of the physician.

Consequently I have thought that it might serve a useful purpose to review before you the causes of death as discovered in the study of my own series of cases.

The remarks which follow are addressed not only to the surgeon, but also to the physician and in particular to those physicians who devote themselves chiefly to the treatment of tuberculosis of the lungs. To the former I must say something about the technique of the operation, and to both something about the proper selection of cases. And to begin with, it is necessary to lay down certain principles which apply to the treatment of all forms of tuberculosis.

The first is that while nearly everybody sooner or later is attacked by the tubercle bacillus, only those who possess resistance by inheritance or their natural constitution, or who have acquired it through environment or treatment are able to overcome this attack. Disregarding the very large number of those who do overcome it without ever knowing they have been attacked, we may consider only the question of declared or clinical tuberculosis. In the patients suffering from clinical tuberculosis, resistance is made evident by certain well known pathological processes, familiar to everybody, chief of which is the replacement of the tubercle by fibrous tissue, representing nature's attempt at healing. Fibrous tissue turns into scar, and the chief property of scar tissue is to contract. Consequently, this first principle amounts to this: that in considering the question of operation we should look for the evidence of scar contraction in diseased lungs, because we must absolutely depend upon the help of nature, that is, of the patient's resistance, to aid

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effectively the surgeon's work. We see this evidence of scar contraction both in the ordinary physical examination and particularly in the X-ray picture. Inasmuch as the ribs form a fixed point while the thoracic organs are mobile, scar contraction will pull the trachea, heart, mediastinum, and diaphragm toward the fibrotic lung tissue and toward the ribs of the affected side.

The second principle is that the fundamental factor in the cure of tuberculosis is rest of the diseased tissue. Thus, for instance, we immobilize joints, and we try to immobilize the lung by putting the patient at rest and reducing the work of respiration. This is exemplified in the ordinary hygienic treatment of pulmonary tuberculosis. In certain cases more complete rest of the affected lung can be brought about by artificial pneumothorax. And finally, when this last is impossible on account of pleural adhesions, the principle is still further exemplified by the operation of extrapleural thoracoplasty, which, by removing portions of eleven ribs, prevents respiration on that side, puts the lung at rest, and also compresses the lung. This is the *rationale* of the operation.

To put it briefly, then, the chief danger arising out of the first principle lies in choosing for the operation patients who do not show natural or acquired resistance; and the chief danger arising out of the second principle lies in putting out of function suddenly too large an area of the diseased lung.

Let us take these up in their order—first, the danger of operating upon patients whose resistance is insufficient to stand the strain of a thoracoplasty. The course of tuberculosis, clinically, may run along two main lines; the one showing a tendency to chronicity, with the gradual laying down of repair tissue in the form of fibrosis and ultimate scar, that is, a tendency toward healing, even if combined usually with some degree of local destruction in the shape of cavities. This is the productive form. The other tends toward activity and is characterized by quietly or rapidly progressive infiltration of a bronchopneumonic type, with or without cavitation and liquefaction, but usually with fever, rise of pulse, and loss of weight and strength. This is the so-called exudative form. Here there is very little evidence, if any, of nature's attempt at repair in the way of fibrosis, and consequently one misses the evidence of scar contraction. Between these two general types comes a large number of cases in which there can be found, as one reviews the histories, a sort of up and down course, with attempts at fibrosis marred by successive shoves of fresh tuberculous infection invading new ground. The number of variations or combinations of these two types is a large one, and each case must be studied on its merits with this fundamental principle constantly in mind. Now it may be laid down as a safe proposition that the patient who shows no evidence of fibrosis, whose history demonstrates a tendency to activity, and whose lesions are at the moment active, even though the disease be strictly unilateral, should not as a rule be operated upon, because the undoubted strain of operation is very likely to aggravate the disease, since nature contributes nothing in the way of help. How much more is this true when, as is often the case, there are present the evidences of similar, even though slight, disease of an active nature in the opposite supposedly good lung. I find, indeed, that a common error is to operate on such patients because of the fact that the disease is chiefly unilateral, in order, as has been said, to give the patient his chance. This is to disregard entirely the fundamental requisite of resistance, without which any strain added to the load which the patient is carrying merely makes that load heavier. The results are apt to be disastrous. The slightly active disease on the good side may easily go on into heightened activity, invade fresh areas of the lung, and become so extensive as to amount to a pneumonia, thus forcing the patient into a negative phase which ends in death within a few days or a few months. Let me emphasize, then, that it is usually impossible to bring help to a patient whose whole history shows that he cannot help himself. On the contrary, only harm is done.

The right selection of cases, therefore, is of paramount importance, and the greatest danger of operation lies much more in lack of judgment in that selection than in eventual

errors of operative technique. I shall perhaps do well at this point to illustrate this statement by a brief reference to the results obtained in my own series of cases. I have divided my patients into 3 main classes: the first includes those of ordinary fibrocaseous disease, of chronic type, in which the lung fills its side of the thorax; the second includes the cases of pneumothorax in which it is proposed to give up the pneumothorax and substitute a thoracoplasty; and the third takes up all the cases of empyema, whether purely tuberculous or grave mixed infections.

Now all of them may be divided again into 3 groups, as regards operative risk: the favorable cases or the so-called good chronics, the doubtful or conditionally favorable cases, and finally the definitely unfavorable risks. Of the good chronics I can report on 47 cases, with 2 deaths from the operation, that is, 4.3 per cent. In one of these, a one-stage operation, the patient died on the eighth day from an acute tuberculous pneumonia of the opposite lung. In this case and one other I broke my rule of never operating in one stage, and I think it probable that if I had taken two stages for the operation the patient would have been alive today. In the second group, that of doubtful cases, there is a series of 71, with 3 operative deaths, a mortality of 4.2 per cent. And in the third group of definitely unfavorable cases, 54 in number, 14 died from the operation, which is a mortality of approximately 26 per cent. If figures can drive home the realization of the necessity of care in the selection of cases, surely these statistics should constitute a sufficient warning in that respect. Our greatest problem, involving our greatest danger, lies here.

It is not my purpose at this time to speak of the favorable results following upon this operation, but I may allow myself a moment to put before you the reverse of the medal. In the class of good chronics, as calculated a year ago, I count 66 per cent of practical cures, that is, of patients restored to community life and able to work, with a further 13 per cent of great improvements. In the cases of the second group, or of doubtful risks, there were 38 per cent of practical cures, and 24 per cent of great improvements; while in the last group, carrying a bad prognosis, there were no practical cures and only about 20 per cent of marked improvements.

Now you can see from these figures that although I have tried to be careful in the selection of cases I have frequently failed. In the fifty-odd patients of the third, or unfavorable, class I was guilty of many errors of judgment. The reason is clear, and I think I can condense it into a few words, which are that, in spite of sticking to the principle of demanding the evidence of scar contraction, I gave insufficient weight to the finding of potentially active lesions on the good side and to the evidence of a general late loss of resistance, coming on after an early period of resistance. Most of these unfavorable cases were on the border line between operability and non-operability, and such are always being sent, in ever increasing numbers, to the surgeon who has acquired a certain reputation in this line. And they are sent sometimes by internists and even by professed specialists, at much too late a period, when they are going downhill, often years after an early stage characterized by resistance and fibrosis, at which time they might have been operated upon safely. Let me say that, when a patient who has been under medical treatment for a period of 1 or 2 years has made clear his resistance by fibrosis, but has obviously reached a stage at which sanatorium treatment can accomplish nothing further, he should then, while he is in good condition, be considered as a candidate for thoracoplasty. He is then still a good chronic and the operation yields very satisfactory results. This remark is addressed chiefly to the medical man, and I would remind him that upon his shoulders lies the primary responsibility in the selection of cases for the operation. The surgeon on his side must always realize that he cannot in his conduct of the case do without the constant co-operation of the internist. It is the internist who, from his long observation of any given patient, is best able to estimate that patient's resistance, to determine the pulmonary condition between stages, and to evaluate the final results.

In these remarks I have discussed the danger which lies in an acute postoperative

progression of the disease through previously healthy, or almost healthy, portions of the lung, in particular of the opposite lung. Death, if it occurs, comes usually only after weeks or months, although in one of my patients it ensued on the eighth day after operation. But there is a second, more immediate, danger to life, which arises from a disturbance of the physiological equilibrium, both of respiration and of heart action. When one removes a sufficient number of ribs and a sufficient length of those ribs, one brings about a reversal of the normal physiological movements of the underlying lung, in the sense that during inspiration this portion of the lung, having no expanding ribs over it to bring it out, follows the expansion of the opposite lung and is therefore pulled in toward the opposite side; while in expiration it takes the opposite movement, being shoved out by the contraction of the opposite lung. This is called paradoxical respiration. The practical result is that this portion of the lung becomes inert and is of very little use, if any, for purposes of aeration. Even the removal of two or three ribs over a length of from 4 to 5 inches will allow this phenomenon to appear. It follows that the more ribs one removes and the greater the extent of the ribs removed, the more lung will be put out of action, and the greater will be the loss of oxygenation and reduction of vital capacity. Not only has this a serious effect upon the patient's ability to breathe properly, but the action of the heart also is interfered with, because there ensues a sort of swinging or flapping movement of the mediastinum and of the heart, corresponding to the phases of respiration. The heart loses its normal support and its work is disturbed. It is the rule that the removal of from 4 to 6 inches of the lower five or six ribs increases the heart's rate by 20 or 30 beats for a period of a week or more. The extra labor is obviously considerable. If all the ribs are taken off at one sitting, as used to be advised by continental surgeons, even a healthy heart is frequently unable to stand the strain. A failing heart then brings on pulmonary œdema, and many a patient in the earlier periods of this operation died in this way in the course of the first few days after operation. On the other hand, it is well known that if the mediastinum has been stiffened by long standing fibrosis or by a pre-existing pneumothorax or by chronic empyema, the extensive removal of ribs is much better borne by the heart, and the pulse rate after operation may rise but very little. These physiological conditions have often been too little regarded by those whose natural mind and whose training have made them confuse fine surgery with fine technique. So that the second warning is not to take off too many ribs, nor too long a piece of each rib, at one time.

We owe to Dr. Hedblom chiefly, in this country, and also to Colonel Keller the principle of the graded thoracoplasty, which means multiple operations and but little at a time. There is no more certain way of playing safe. At a time when the continental practice was all in favor of removing ten or eleven ribs in one stage, the wiser surgeons were advising two stages; and at the present moment there is a distinct tendency, to which I heartily subscribe, towards a three-stage operation. My own opinion is that whenever there is a suspicion of recent activity in the good lung (if this were a certainty one would not operate at all), it is well to remove no more than three or four ribs at a time; but in the majority of cases, properly selected, it is safe to remove from the sixth to the eleventh inclusive at a first stage and the upper five about 2 weeks later. As a matter of fact, as one sees from photographs taken between the two stages, the removal of the lower six ribs does not put a very large area of lung out of commission. The collapse of the chest wall is kept within reasonable bounds by the buttress of the upper five ribs. On the other hand, if one begins at the top and removes the upper six or seven ribs first, as has been advised particularly by Alexander and by Lilienthal, the degree of lung collapse is very much greater, and the sudden interference with aeration, the sudden large loss of vital capacity, constitutes a distinct element of danger. If, in addition, the myocardium is not normally sound, the danger becomes most threatening, and in the few cases in which I have tried this method, the mortality has

been excessive. This warning, therefore, is addressed particularly to the surgeon. Let him not be misled by the facility of rib removal, or by the consciousness of doing a technically pretty operation, into removing more than six of the lower ribs at one time.

A corollary to this proposition concerns the length of rib that should be removed. Sauerbruch advised taking out not more than from 4 to 8 centimeters of any one rib. His operation, in that sense, is called the paravertebral operation. Brauer, on the other hand, contended that, in order to secure sufficient collapse of the lung, one should take away practically double the length mentioned by Sauerbruch, so that in his operation the thorax underlying the scapula also disappeared, and his procedure was called the paravertebral-scapular operation. The published results make clear a distinct difference in the mortality rate. Brauer's larger resections involved a higher mortality rate, although his contention is that they result in a higher proportion of practical cures.

The surgeon who is new to this work will de well to follow Sauerbruch and always remove less rather than more. For my own part I think that one should judge the amount of rib to be removed by the behavior of the lung, as observed during the operation. If, after removing the tenth, ninth, and eighth ribs, in a length of 5 to 6 inches, one notes paradoxical respiration, one must conclude that the loss of vital capacity is going to be a considerable one. Then a shorter length is taken of the seventh and sixth, and the removal of the eleventh, always done last because it forms the last support of the diaphragm, may even be postponed to the second stage. During the 2 weeks following, the patient's respiratory balance becomes fairly well re-established, and one may then safely take out the upper five ribs in lengths of 4 to 5 inches, tapering off at the top to a length of 3 inches of the second, and 1 inch of the first, rib.

As experience in this branch of surgery is still not common property, I think it very important that these dangers of which I have spoken should be fully realized. Otherwise, because of the relative facility with which the operation can be done, the tendency will be to do it in unsuitable cases, if only from mistaken humanitarian reasons. The inevitable result will be an unduly high mortality, and consequently the operation will suffer a discredit which it does not deserve, and proper candidates for the operation will be frightened into a refusal.

A paragraph or two may be given to technical details. I have almost invariably used general nitrous oxide gas-oxygen anæsthesia combined with a small amount of novocain for the skin and the intercostal nerves. I fear local anæsthesia alone, believing that it carries with it two dangers: that of novocain poisoning (from which I find recorded in the literature 7 deaths), and that of wound infection. Novocain renders the tissues less resistant to infection, and the anæsthetization of the intercostal nerves through the intact skin is open to the objection that the needle, in unskilled hands, may be driven into the lung and carry infection back into the soft tissues of the thorax.

I have not found any greater danger of extension of the disease to healthy lung, on account of interference with cough from the general anæsthetic, than is reported by those who insist upon this danger and will use nothing but local anæsthesia. I think, too, there is some slight danger in cough as a factor in splashing fluid tuberculous pus into other lobes. Consequently I give two hypos of morphia during the hour before operation, and I give a general anæsthetic, the whole being sufficient to abolish cough, as well as pain and mental distress. The result is a quiet patient and a quiet, orderly operation. The requirements of the patient's safety as well as his comfort are fully met, while the surgeon's comfort, a not unimportant factor, is greatly increased.

I have had under my care 212 cases of pulmonary tuberculosis for which some form of surgical treatment has been undertaken. Of these, however, only 172 have been subjected to a thoracoplasty. In the remainder such minor procedures as phrenicotomy, apicolysis, cutting of pleural bands, and costectomy, for drainage only, have been done. Of the 172 thoracoplasties there were 135 in which the

lung filled its side of the thorax; 12 in which a pneumothorax, partial or complete, was replaced by a thoracoplasty; and 25 in which an empyema cavity, with or without a partial pneumothorax, was obliterated or reduced in size by a thoracoplasty. Now it is an interesting thing that 16 deaths, a great majority of all those ascribable to operation, occurred in the first series of 117, while in the 55 cases of the second class there were only 2 deaths. The reason is clear. When the mediastinum has been stiffened by a long continued pneumothorax or an empyema, one escapes the danger of disturbance of the respiratory and cardiac function.

CONCLUSIONS

In conclusion, may I set down a brief analysis of the causes of death in the 19 patients who succumbed? Of these deaths, 7 resulted from an acute spread of tuberculosis in the opposite or good lung within a period which varied from 5 days to 4 months. In some of these, undoubtedly, secondary heart failure and pulmonary œdema, coming on within the first week, played a secondary rôle but decided the issue. Three of these 7 showed before operation a definite though slight activity of the disease on the good side and should not have been operated on at all. One was a one-stage operation, which in my opinion is to be condemned. In the other 3 cases, rapid extension of disease must be accepted as one of the accidents belonging inevitably to any large series of cases. I do not know how certainly to forestall such disasters.

Of the same nature is 1 death that occurred from typhoid contracted in the hospital in the course of a most promising convalescence. Acute myocardial failure caused death in 2 cases on the second day after operation, both after the first stage in which the lower five and six ribs had been removed. One of these had shown some myocardial disease in the electrocardiogram taken before operation. Both were adjudged bad risks before operation. It is most important to estimate the strength of the myocardium before doing a thoracoplasty, and, when there is any doubt of the ability of the heart to stand the strain, the operation should be done in not less than three stages. One patient died of miliary tuberculosis, which may or may not have been precipitated by the operation. One died of cardiac failure on the twelfth day after the operation, a first stage in which the fourth to the tenth ribs inclusive were removed. This patient was likewise a bad risk. The warning is again not to take off so many ribs at one stage. Another patient died of a secondary hæmorrhage occurring in the gravely infected wound on the seventh day after the second stage. This patient and 1 other, who died of a streptococcus septicæmia 21 days after a first stage, represent the only deaths from wound sepsis in the whole series of over 200 cases, and it should be remembered that this represents also about 400 separate operations. Infection of the wound has been remarkable by its absence. One patient died of a most curious accident, a spontaneous pneumothorax in the thorax of the opposite side, the cause of which I cannot explain. Three patients who had survived quite well a total posterior thoracoplasty, but in whom persistent cavities at the apex suggested a further attempt at compression, succumbed to an extensive apicolysis (carried out in front) in from 5 to 14 days. These were among my early cases; they were all in desperate condition; and with my present experience I should not think of undertaking such an operation. They died from pulmonary œdema consequent upon gradual heart failure combined with spreading bronchial infection. Two others died from the same cause after the usual posterior operation.

As you see, gentlemen, I have made not a few mistakes. The majority of them were due either to insufficient experience, or, with increasing experience, to insufficient caution. Others can be ascribed to the uncertainties of a refined pathological diagnosis, or, finally, to the mistake of yielding to the pleading of patients. This last mistake can best be avoided, and the patient still satisfied, if one explains that the patient's best chance lies in further delay (as, indeed, is perfectly true in some instances), that there is need for further building up, and that the operation may only be postponed. But in the last analysis the most frequent mistake lies in operating upon

patients who simply are too sick to bear it. After all, we, the declared adversaries of the Old Man with the Scythe, with whom there can never be truce, must still realize that Dame Nature has accorded him certain confines within which his power prevails against us and must ever prevail. And his habeas corpus, served and carried out, may be a more merciful act than our own writ if it takes the form of a grave and painful operation. Pallida Mors (forgive the change of gender) may lay upon the poor victim of an inescapable summons a gentler hand than that of the surgeon whose outlook upon his own science is of the mechanical kind. *Nil nocere!*

The moral I draw is that for the sake of the credit of the operation and for the encouragement of other better candidates, the definitely bad risk must be excluded from operation until, at any rate, we learn how to reduce the strain of the procedure and make it more safe for those who can bear very little. By strict observance of this principle we can certainly reduce the operative mortality in favorable cases to 4 per cent and Sauerbruch has claimed a still lower mortality rate in this group. The operation of thoracoplasty on the tuberculous subject is still regarded by very many as a most formidable one, to be advised only as a last resort. It *is* formidable in some types of the disease. But if, knowing the danger, we exclude such types from operation, we can make it one of the least dangerous and most beneficent of all major operations.

DISCUSSION

DR. CARL A. HEDBLOM, Chicago: One of the chief difficulties inherent in evaluation and comparison of results of treatment in any field is lack of uniformity in the classification of types of cases and of results. There is a particular need for clear-cut definition and uniform classification in the consideration of disease conditions having the wide range of variations as to pathology which is characteristic of tuberculosis. The surgical treatment of pulmonary tuberculosis is of relatively recent development and in the opinion of some is still on trial. It is important, therefore, to have a clear understanding as to types and the indications and results of treatment in each. It seems fitting that a classification meeting this need should come from the pioneer in the surgery of pulmonary tuberculosis on this continent. In my estimation Dr. Archibald's classification merits careful study and general adoption.

I should like to add all possible emphasis to the statement that "no other thing is so important as to realize that the essential difficulty lies in the judicious choice of the patient." This implies not operative skill—important as that is—but judgment based on knowledge of, and clinical experience with, pulmonary tuberculosis on the part of the physician, surgeon, and roentgenologist in close collaboration. Injudicious choice of patients means poor results and unmerited discredit of a method of treatment based on sound principles and abundantly able to prove its worth.

The close relationship that exists between indications and results is shown strikingly by Dr. Archibald's statistics. In his group of "favorable cases," 83 per cent were cured or greatly improved following thoracoplasty and the operative mortality was only 3.3 per cent, whereas in the group classified as "unfavorable" only 33 per cent were improved and there were 38 per cent operative, and 28 per cent non-operative, deaths. In other words, in the unfavorable group, one-third of the patients were improved while two-thirds died.

Unerring pre-operative classification can be only approximated, and as stated some unfavorable cases are operated upon to give them the benefit of the doubt. Every effort should be made, however, to eliminate this group. In my experience the preliminary pulmonary phrenic nerve operation has been of great value as a test operation. Some patients who seemed decidedly hopeless have been converted by it into cases favorable for thoracoplasty, following which they have achieved a complete clinical cure. The benefits of this simple phrenic resection are sometimes most remarkable. In any case, it adds to the rest and compression afforded by later thoracoplasty.

Generally speaking, patients showing a rapidly progressive downward course are poorer risks than they appear at the moment, while patients distinctly on the mend are more favorable than they seem. Patients reduced to a critical state by profuse hæmoptyses are more favorable for thoracoplasty than they seem, provided the operation is preceded by a transfusion of blood.

Time will permit only passing mention of tuberculous empyema. May I stress Dr. Archibald's statement that every possible effort should be made to avoid secondary infection by tube drainage or rib resection? Mild mixed infection responds to needle aspiration. Bronchopleural fistulæ are avoided by early obliteration of the pleural cavity. Posterior thoracoplasty followed by anterolateral costectomy will reduce the cavity to small proportions. If there is no secondary infection the residual cavity will usually become obliterated spontaneously. If there has been open drainage I always obliterate the persistent residual cavity by a pleural resection which is well tolerated.

Dr. Archibald expresses the hope that the high mortality in the "poor risk" patient may be reduced by a three or four stage operation. I should like to

express my conviction that the mortality will thereby be reduced and the indication for the operation extended. Thoracoplasty is identical in principle with artificial pneumothorax in that it produces rest and compression of the lung. The more the thoracoplasty operation can be made to approximate an artificial pneumothorax refill with respect to its effect on the general condition of the patient, the safer it will be. Longer segments of ribs may be excised without mediastinal flutter, securing, thereby, a more adequate collapse.

Allowing a longer interval between stages allows the patient to recuperate and lessens the gravity of a wound infection should it occur. If rib regeneration interferes with the ultimate degree of collapse a later anterolateral costectomy will effect a maximum degree of collapse. The all-important consideration is an ultimate adequate collapse effected by as many stages as the patient's condition seems to necessitate.

To summarize: conservatism in the selection of patients, pre-operative management, adaptations of the operative procedure to the individual patient, and following through to an adequate degree of lung collapse will extend indications and improve results.

DR. RALPH B. BETTMAN, Chicago: Collapse and immobilization therapy in tuberculosis has progressed from the early crude attempts with posture, application of weights to the affected side, or strapping the chest wall with adhesive, to the present stage of artificial pneumothorax and extrapleural thoracoplasty.

The operation of extrapleural thoracoplasty brings about a permanent collapse and compression that is excellent. A large share of the credit of popularizing, in this country, this operation first conceived in Germany belongs to Dr. Archibald. The greatest factor of safety which has been evolved in connection with the operation *per se* has been the division of the procedure into two or more stages. Here again Dr. Archibald has been a leader.

Although in general the operation now most commonly used has been but little changed from its first form, our knowledge concerning it has been greatly enhanced.

The multiple stage operation has practically supplanted the single stage operation. The importance of including the first two ribs in the resection has been so clearly shown that in spite of imaginary difficulties in technique, no one today would omit this step. The use of ethylene either alone or in conjunction with local anæsthesia has simplified the operation for the surgeon and done away with much of the mental shock for the patient, because no matter how complete the local anæsthesia, the vibration and sound of the actual cutting of the ribs was a horrifying sensation.

One of the dangers subsequent to extrapleural thoracoplasty has been cardiac embarrassment. For the last 2 years, Dr. W. S. Priest and I have been studying the reaction of the heart to the changes in position and intrathoracic pressure subsequent to thoracoplasty. This work has been done in our "heart station" at Michael Reese Hospital, where we have taken electrocardiac tracings on all cases before and after operation. We have found that the patients in whom the respiratory mobility of the heart before operation was great were most apt to suffer from postoperative cardiac embarrassment. Patients in whom change in position of the heart was that of a shift rather than a rotation seemed to suffer least. The operation of thoracoplasty seems to throw more of a burden on the heart than does a laparotomy, and a heart with myocardial damage, which might withstand the strain of a cholecystectomy or stomach resection, may not withstand even a multiple stage thoracoplasty. On the other hand, a healthy heart can tolerate surprisingly large shifts to one side or the other, as long as little or no rotation occurs. Just how far we will be able to apply our results to practical advantage is difficult to say.

In evaluating the operation of thoracoplasty it must be remembered that in practically every case other remedies have proved ineffective, and that to a large group of individuals thoracoplasty is the only bridge spanning the gap from the sanatorium to active outside life. In my own series of thoracoplasty, 40 per cent are back in industry. The interesting point about this fact is that every one of these cases except for thoracoplasty would now either be dead or languishing in a sanitarium.

To my mind there is no question that at present the greatest danger of unnecessary loss of health and life associated with the operation of extrapleural thoracoplasty results from withholding the operation in suitable cases because of ignorance of the operation or failure to comprehend the possible good it may offer, rather than from any or all operative catastrophes.

A METHOD OF REDUCING THE INCIDENCE OF FATAL POSTOPERATIVE PULMONARY EMBOLISM

Results of its Use in Four Thousand Five Hundred Surgical Cases[1]

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CLINICAL investigation has been, and should continue to be, a reliable method of securing information. We have but to review the work of Richard Bright on nephritis, that of Addison on tuberculosis of the suprarenal glands and on pernicious anæmia, and the many recent advances in medicine developed by deduction from clinical observations substantiated by postmortem reports to appreciate the value of clinical investigation. Experimental investigation and research leading to deductions referable to clinical problems have so well justified themselves that unless deductions made from clinical investigation are proved to be facts by animal experimentation we may look on the results of such work as suggestive but not proved. Pulmonary embolism is one of the great surgical problems. Unfortunately, up to the present time, it has been difficult to produce pulmonary emboli experimentally in a manner which simulates their formation in human beings. In more than 60 experiments on animals, Miller and Rogers were unable to produce pulmonary emboli that might be compared in formation and condition to emboli in human beings. The deductions which I am making in the presentation of this material are essentially the result of clinical investigation. Yet these investigations carried on over a period of 4½ years in a large group of cases have proved of great clinical value.

Many physiological changes and adjustments follow surgical procedures. Those seemingly concerned in the formation of postoperative pulmonary emboli are: (1) decrease in metabolic activities; (2) the tendency toward a decrease in the rate of blood flow (pointed out by Virchow in 1846) with a decrease in blood pressure; and (3) changes in the cellular constituents of the blood.

These conditions may be the result of: (1) rest in bed without food; (2) interference with circulation by intra-abdominal manipulation; (3) forty-eight hours of intestinal quiet after intra-abdominal operations; and (4) muscular splinting of the abdominal wall because of a painful incision.

Any method which would cause an increase in metabolism, in rate of the flow of blood, and in blood pressure should decrease the incidence of fatal postoperative embolism. The metabolism can be increased effectually by the use of desiccated thyroid gland. Clinical support of the value of increased metabolism in the prevention of thrombosis and embolism is lent by Plummer's observation that in cases in which the thyroid gland is hyperfunctioning, thrombosis and embolism practically never occur even when disturbances of blood flow are extreme from associated cardiac decompensation. In contrast to this is the frequent association of thrombosis and often fatal embolism in patients with primary cardiac decompensation. When 1 milligram of thyroxine was administered daily for 3 days to rabbits by Shionoya and Rowntree, thrombosis did not occur for from 25 to 30 minutes, in contrast to thrombosis occurring in their control animals in from 4 to 10 minutes. This change in blood flow and the late formation of the thrombosis following thyroxine experimentally administered by them was sustained for 3 days.

The tragic deaths from pulmonary embolism are those occurring in patients who, except for the lesion for which they are being operated on, are in good condition. Most of the reported deaths from fatal pulmonary embolism have occurred in patients of this type, yet death did not occur among patients of this type in the series of 4,500 surgical cases in which the method of prevention which I am presenting was used. Any method of reducing the incidence of postoperative pulmonary embolism should have its greatest possibility in this group of cases. Attention, therefore, is

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directed to the fact that in contrast to success of the regimen among patients who are in good condition, experience seems to show that cardiovascular disease or diseases of other parenchymatous organs which debilitate or weaken the patients predisposes to the formation of thrombi and emboli. One of the most important factors concerned probably in their production is the change in blood flow occurring simultaneously with decompensation of the function of these structures.

In the statistical review by Henderson of 313 cases of pulmonary embolism in The Mayo Clinic during the 10-year period from 1917 to 1927, there were 46 non-surgical cases in which fatal embolism occurred. Half of these patients had myocardial degeneration with marked decompensation. In some of the non-surgical cases, pulmonary emboli were found unexpectedly at necropsy, when death had appeared to be due to cardiac failure from myocardial degeneration, peritonitis, bronchitis, or hæmorrhage, and embolism had come into the picture as a terminal event.

Kuhn, at the Institute of Pathology at Freiburg, recently reported that the incidence of fatal embolism in Germany from 1924 to 1927 increased from 1.3 to 4.9 per cent, whereas in 1927 thrombosis was found in every fourth body examined, and fatal embolism was found in every twentieth body. He stated his belief that this increase in the incidence of thrombosis and embolism is the result of prolonging life by the treatment of patients with chronic disease of the heart. With such disease, changes in the flow of blood occur.

Further evidence of the tendency to the formation of thrombi and emboli in patients who are debilitated by disease is found in the fact that the incidence of fatal postoperative embolism was three times greater after cystostomy preliminary to prostatectomy on debilitated patients than after the same operation performed on patients in good condition. The effect of cardiovascular disease and disease of the parenchymatous organs as the predisposing and probably uncontrollable factor of pulmonary embolism has been emphasized because of the problem of compensating for these fixed pathological changes and because it emphasizes the influence of changes in the flow of blood in the formation of such emboli.

In the series of 4,500 surgical cases which I am reporting, pulmonary emboli were found at necropsy in 4 cases; 3 of the patients were more than 70 years of age and had advanced cardiac disease. In 2 cases pulmonary emboli were found unexpectedly at postmortem examination; death was the result of uræmia in 1 case and of sepsis in the other. The other patient, a woman aged 54 years, had auricular fibrillation, and died on the sixth day following her operation. She had received only 4 grains of desiccated thyroid gland the preceding day.

Since mention has been made of the predisposition of elderly patients with debilitating disease to the formation of thrombi and emboli, especially in cases of cystostomy as a preliminary to prostatectomy, it is of interest that in this series of operations 779 were performed on the prostate gland and bladder; 273 of these patients were in too uncertain a condition to warrant primary prostatectomy and so cystostomy was performed. Of the 4 patients who died from embolism, 2 had had cystostomy as a preliminary to prostatectomy; both patients were more than 70 years of age.

METHOD OF REDUCING THE INCIDENCE OF POSTOPERATIVE EMBOLISM

In order to combat the decrease of metabolism, the decrease in blood pressure, and the slowing of circulation, tablets of desiccated thyroid gland in doses of 2 grains, administered 3 times daily, have been used in all cases except those in which there has been an abnormal increase in pulse rate and temperature occurring as a spontaneous postoperative reaction. Cases in which the desiccated thyroid gland is not given will comprise approximately 10 per cent of the total number. Inasmuch as the increase in temperature and pulse rate in this small group occurs spontaneously, which means an increase in metabolism and flow of blood, it has not been felt necessary to add further to the reaction by the administration of desiccated thyroid gland. The administration of desiccated gland is begun as soon after operation as the gastro-intestinal tract tolerates fluids and drugs, usually from the second to the fourth days, and is continued until the

patient is out of bed, usually the tenth day. In any event the administration of the gland is stopped by the twelfth day. If marked elevation of pulse rate and temperature occur, it is discontinued sooner. In 3 cases compound solution of iodine (Lugol's solution) was given to counteract its effect, which it did successfully and without harm to the patient.

Since an increase in metabolism, which also may mean an increase in both temperature and pulse rate, is the primary object of giving the desiccated gland, it cannot be considered a deleterious effect. Other untoward effects have not been noted. If, during its administration, the patient is nauseated or vomits, it is discontinued. Also patients have been urged to move in bed, to flex their legs and arms, and especially to turn themselves from side to side, as advised by Wilson and Pool. Not infrequently even on a surgical service in which such a regimen is considered a routine procedure, one may find an occasional patient who, during the surgeon's absence, has not moved from the position in bed in which he was placed when he returned from the operating room or who has not received the desiccated thyroid gland. This emphasizes the necessity in each case of the surgeon seeing to it that whatever regimen is outlined should be carried out, for if this is relegated to others, its importance may not be recognized. Such a regimen has been used during the last 4½ years in the management of 4,500 surgical cases on my service, consisting for the most part of intra-abdominal operations on the gastro-intestinal, the biliary, and the genito-urinary tracts.

The method of reducing the incidence of fatal postoperative embolism described might be expected to have a field of application in all cases except those of elderly patients with marked cardiovascular disease or disease of other parenchymatous organs which has weakened and debilitated the patient. On the surgical service of my colleague, C. F. Dixon, this regimen has been followed in all cases (except cases of hyperthyroidism) during the last 2 years, without a death from postoperative pulmonary embolism.

Undoubtedly there are factors other than slowing of the rate of metabolism, lowering of blood pressure, and possible retardation of the circulation that are responsible for the formation of thrombi and emboli, else the incidence of postoperative embolism would be much higher. It seems reasonable, however, that they set the stage, and whether infection, as may be inferred from Rosenow's isolation of streptococci from emboli at necropsy, or changes in blood or tissue fluids are the exciting factors is as yet undetermined. However, lowering of blood pressure, depression of metabolism, and possibly slowing of the circulation as a result of prolonged rest in bed, with great diminution of peristalsis and the restricted excursion of the diaphragm, following operation play an important part in either the predisposition to, or the causation of, postoperative thrombosis and embolism. Attempts have been made to overcome these changes through increasing the metabolic rate by the use of tablets of desiccated thyroid gland and early movement of the patient in bed.

SUMMARY

In a study of 267 cases of fatal pulmonary embolism following 63,347 major operations during the 10-year period from 1917 to 1927 at The Mayo Clinic, Henderson found the average incidence of fatal postoperative embolism to be 0.34 per cent.

The use of a regimen directed toward increasing the rate of metabolism, of blood pressure, and of blood flow in 4,500 major surgical procedures of comparable type during the last 4½ years has been followed by an incidence of fatal pulmonary embolism in less than 0.09 per cent of cases.

Of the 4 patients in this series who had pulmonary emboli, 3 were aged 70 years or more, and of those, 2 died from other causes (sepsis in 1 case and uræmia in the other). The age of the third patient was 54 years, and in this case auricular fibrillation was present. In each of the 4 cases there was myocarditis at necropsy; it was marked and associated with coronary sclerosis in 3 cases. These 4 cases illustrate the predisposition of patients with cardiovascular disease to the development of postoperative emboli, and emphasize the part played by disturbances of the blood flow in their formation.

Fatal pulmonary embolism did not occur among patients in good general condition when the described regimen of prevention was carried out.

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DISCUSSION

DR. EDWIN M. MILLER, Chicago: The endeavor of the essayist in this piece of clinical research is worthy of commendation, for though the incidence of fatal postoperative pulmonary embolism is relatively small, the fact that the accident usually happens with such frightful suddenness and with such surprising unexpectedness, often at a time when the patient is well on the way to recovery, would make any well defined program directed toward its elimination, or even reduction in frequency, more than welcome. We have heard presented such a method, adequately tested, and of proved value. Nothing, it would seem on the face of it, should stand in the way of its acceptance.

General acceptance, however, of any new therapeutic measure, no matter how attractively presented, seldom is quickly gained, because first must be overcome a natural reluctance due partly to lack of knowledge of the new procedure and partly to faith in existing methods, a frame of mind which stimulates one to investigate all phases of the proposition before being convinced of its merit.

What are the facts surrounding cases in which a fatal pulmonary embolism has followed an operation? From a review of reports published within the past few years, especially from the German clinics, and from information received directly from pathologists, the following statements may be made without reservation:

1. The incidence of proved cases is very small.
2. The majority of the patients are well advanced in years, usually above the age of 60.
3. The operation is usually on the midportion of the body, especially the lower abdomen or pelvis.
4. The pathological condition is very frequently a caricinoma.
5. The accident is most apt to occur during the convalescent period, without pre-existing œdema, swelling of the legs, thrombophlebitis, or any other clinical sign which would attract the attention of the clinician to a likelihood of its occurrence.
6. At autopsy the site of origin of the thrombus is almost always found to be in the iliac or pelvic veins, or right auricular appendage. The length, caliber, and shape of the clot are sometimes the only clues to its origin, because of the almost constant absence of any local inflammatory change in the endothelial lining at the original site.
7. After giving due consideration to the influence of the multitude of factors which may or may not contribute to the etiology, the outstanding single factor concerned is stasis of the blood in the large veins of the pelvis.

What, then, may be done to influence this situation? Certainly much may be accomplished by methods already at our disposal: (a) careful preoperative study of each case, especially in those of advanced years, providing aid through digitalis to a weak or failing circulation; (b) careful operative technique—clean-cut dissections, accurate hæmostasis, and avoidance of mass ligation and undue pressure on great veins by retraction; and (c) diligent postoperative care, the paying of particular attention to adequate fluid intake, and intelligent use of digitalis, caffein, or other drugs acting directly on the circulation. Tight bandages should be avoided, and especially should the free mobility of the chest be preserved. Frequent change in the position of the patient, the encouragement of early systematic exercise

of the arms and legs, and especially daily elevation of the foot of the bed as a mechanical method of increasing the venous flow from the dependent pelvic region, are important in the prevention of stasis of the blood.

It is a question in my mind whether, having done these things in the hope of avoiding a fatal pulmonary embolism, much more would be accomplished by the use of thyroid extract, unless it is definitely shown that, on account of the slight rise in metabolism which follows, the rate of flow is accelerated or the pressure elevated in the great veins of the pelvis, which are most commonly the original site of the thrombus.

Dr. Vernon C. David, Chicago: While an average of from 1 to 3 instances of postoperative pulmonary embolism usually occurs in large clinics in every 1,000 cases operated upon, there seems to have been a decided increase during the last few years. This may be more apparent than real, as Detering of Frangenheim's Clinic has pointed out, for in a chart covering the incidence of embolism since 1900 in the Cologne Clinic there was seen to be nearly as marked an increase in 1909 as there has been in the last few years. However, between the years 1923 and 1926 there has been a threefold increase in postoperative pulmonary embolism in Schmieden's Clinic and this is typical of many other clinics, including those of Rost and Bier. Concurrent with this has been the relative increase of thrombosis in patients after operation. Fatal embolism in non-operative cases and in medical cases also has increased during the same period but not as rapidly. In 30,000 cases in the Chemnitz Clinic, Martini reports an incidence of 0.22 per cent fatal postoperative embolism from 1917 to 1928 while 0.1 per cent occurred in patients who were not operated upon.

Clinical details. The usual time of appearance of postoperative embolism has been between the sixth and tenth days after operation. The majority of instances occurred in patients between 50 and 70 years of age. Obesity seems to be a predisposing factor. The type of anæsthesia seems to have no causative relation. In some statistics, cancer was present in as many as 33 per cent of the patients. Preceding infection, such as influenza or tuberculosis, is commonly present in the antecedent history.

The type of operation seems to play an important predisposing rôle in postoperative embolism. Abdominal and pelvic surgery leads the list in about 70 per cent of the cases. Stomach surgery, especially for cancer of the stomach, and pelvic surgery, particularly operations for prostatic hypertrophy and fibroids of the uterus, are the most important. Gall-bladder surgery and surgery of the large bowel, including removal of the appendix, also are followed by fatal embolism. Hernias, too, play rôles, while surgery of the extremities is rarely complicated by embolism. Thyroid surgery is particularly free from postoperative embolism. It is of interest in this connection that Frund from the Garre Clinic has reported a decrease in the number of postoperative emboli following the administration of thyroid extract to patients about to be operated upon.

Tempsky tabulated a series of operations for carcinoma of the stomach, carcinoma of the rectum, and appendicitis, from the Kuttner Clinic, in relation to postoperative thrombosis and embolism. In 1,458 cases of carcinoma of the stomach there were 45 postoperative thrombi and 12 emboli. In 496 of these cases, resection of the stomach was done with 17 postoperative thrombi and 5 emboli, which is at the rate of 1 embolism in every 100 cases.

In 506 cases of carcinoma of the rectum there were 27 postoperative thrombi and 17 emboli. Of these cases, 304 resections of the rectum were performed with 23 postoperative thrombi and 12 emboli or nearly 5 to every 100 cases.

Contrasting sharply with this was the report of 1,767 cases of appendicitis in which there were 29 thrombi and 4 emboli or 2 to a thousand, which is about the usual rate.

Pathological anatomical considerations. While visible peripheral thromboses of the internal saphenous vein are most common, fatal postoperative emboli rarely originate from this source, as it is found that 50 per cent of postoperative pulmonary emboli have their source in the femoral or iliac veins (Lubarsch). While occasional thrombosis of these veins may occur because of direct trauma, from a mass ligature, or from the direct action of an infectious process, in most instances these veins are not in the immediate operative field. The underlying cause of thrombosis must be discovered in factors not purely obvious.

Of these the importance of slowing of the circulation in veins has been emphasized by Ashoff and his school as an important factor predisposing to thrombosis. The platelets and white blood cells linger in the periphery of the vessel where the stream is the slowest and lay down on the endothelium of the vessel a white coagulen from which a thrombus starts. The factors influencing slowing of the blood stream in the large veins occur not infrequently in surgical patients. Among the most important of these factors are loss of blood, shock, loss of fluids from catharsis or excessive perspiration, weak heart action, and interference with the action of respiratory movements due to the pain of abdominal incisions. Of all the cases having postoperative embolism, Bauer from Koenig's clinic stated that about one fourth were noted to have cardiovascular lesions before operation but that at autopsy the heart was found to be affected in 95 per cent.

Ribbert has emphasized the importance of *injury to the intima of the blood vessels* in promoting thrombosis. Endothelium occurring in any of the structures of the body, including the veins, is subject to injury and degenerative changes by reason of infections, toxins from cancer growth, injury from the use of intravenous medication, and many other agents. Thrombosis is especially likely to occur where, in

addition to the injury of the intima of the veins, the blood stream is also slowed.

The third contributing factor, and possibly the most important, is the change taking place in the blood itself after operations, especially after operations on patients who are aged, who have cancer, who have cardiovascular disease, or who have recently undergone severe general infection. Bancroft and his collaborators have shown, after careful blood studies, that patients with postoperative thrombosis and embolism have an increase of blood clotting factors in their blood and usually a diminished amount of anti-thrombin. Govaerts, at the International Surgical Congress this past summer, advanced the interesting theory that injury to the blood platelets with their consequent viscosity brought about by infection was a primary cause of postoperative thrombosis. He said it was a common finding to recover micro-organisms from the clot causing the embolism.

Martin recently published the results of some interesting experimental work on postoperative embolism. He created emboli by the injection of iron chloride intravenously and watched under X-ray the thrombus proceed to the lung. Its course was slow and vacillating through the vena cava and occasionally it passed backward against the blood stream. When it reached the region of the diaphragm, it shot forward into the heart, aided by the sucking action of the accessory movements of respiration. From his study he believed that thrombi which did not occlude the vein or which reached beyond their point of vessel wall attachment into a larger vein were most apt to be detached and become emboli.

Prevention. Until more definite facts are known concerning the mechanics and chemistry of blood coagulation, our efforts must be aimed at removal of factors which predispose to thrombosis.

Before operation the patient should be out of bed as much as possible and fluid should be taken freely on the days preceding the operation. Purges *preceding the operation* with their consequent loss of body fluid should be avoided. If there is any question about the strength of the heart, digitalis should be given, but intravenous medication should be avoided. Varicosities of the extremities should be lightly bandaged with bias cut flannel bands.

At the operation, extreme care should be taken to avoid loss of blood and trauma, such as mass ligatures. Heavy mechanical retractors should be avoided.

Postoperative procedure. The patient should not be allowed to remain in one position during the first few days when so little inclination exists to move. The position of the legs should be frequently changed, and in almost all abdominal surgery the patient should be turned on the side for certain periods during the day. Tight abdominal dressings should be avoided. The fluid content of the bowel should be maintained. Heart stimulants should be used where cardiovascular incompetence is suspected. In accordance with the recommendation of Walter and Frund, small doses of thyroid extract may be given.

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REPORT OF A CASE OF PAROXYSMAL HYPERTENSION CURED BY REMOVAL OF AN ADRENAL TUMOR[1]

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THE patient, L. W. H., male, aged 39 years, married but without issue, reported first in May, 1927, complaining of peculiar attacks, occurring apparently without reason or warning, which had begun in February, 1927. Most of these attacks had, up to this time, occurred while he was in bed, and they were accompanied by an unpleasant sensation in the epigastrium, similar to, but not exactly, nausea. At this time they were of short duration, probably 30 or 40 seconds, and passed off without other definite symptoms. His color during the attack was said to be "sickly green."

His past history, as well as his family history, contained nothing worthy of comment. Except for the period of the attacks he "felt fine."

Complete physical and laboratory examinations revealed negative results except for white blood cells of 14,000 and slightly increased eosinophiles, i.e., 3.5 per cent, and a maximum systolic pressure consistently near 110. Urinalysis, complete X-ray examination, duodenal drainage, liver and kidney functional tests, all were negative.

From that time on, except for short periods, one lasting 30 days but most lasting only 4 or 5 days, these spells recurred similarly. Gradually the patient began to notice that assuming certain positions, especially one of slight inclination forward and to the left, would bring them on. It became possible then to produce them at will and make it possible to examine him during such an attack.

Within a few minutes after assuming the position he complained of the peculiar sensation, his maximum systolic pressure would rise from 110 to 200 or more within a period of 90 seconds and his heart slowed down to about 55, showing an unusually forcible beat, sufficient to shake the bed or chair he was occupying. His color was ashen, and he felt "terrible." This condition rarely lasted over 3 or 4 minutes, the pressure dropped as rapidly as it had risen, and within 10 or 15 minutes he felt "as well as ever."

Continued observation revealed nothing new. The white count varied from 14,000 to 20,000, with a persistent moderate eosinophilia. As the months passed, mild renal degenerative signs gradually manifested themselves. In addition, mild cardiac embarrassment was noticed, shown by slight dyspnœa on exertion, occasional tendency to tachycardia following the "attacks," and a very greatly increased period of disability and discomfort following the periods of hypertension.

Consultation with several eminent specialists revealed nothing further and nothing any more definite than what has been already cited.

Accordingly, in view of the analogous cases reported by French clinics, Dr. Charles Mayo, Dr. Shipley, and others, it was felt that the diagnosis, obtained by a process of elimination, of possible adrenal or chromaffin-cell tumor was sufficient ground for an exploratory laparotomy. Ready acquiescence on the part of the patient was forthcoming because he felt he was growing worse.

The strikingly paroxysmal character of the attacks and their short duration made it reasonably certain that the offending source was operating through the autonomic nervous system, and no likelier source could be suggested than an adrenal or chromaffin origin.

OPERATION

On June 19, 1929, a vertical midline epigastric incision was made. Nothing abnormal was discovered on the left side, but on the right side a globular tumor occupying the right renal region was found and first mistaken for an abnormal-shaped kidney. On further examination, the kidney was outlined a little below and behind the tumor, which was slightly movable and retroperitoneal.

A transverse incision was made to connect with the vertical incision for better exposure of the tumor. The peritoneum was incised and the tumor removed with little difficulty and without much hæmorrhage, although it had attached to it numerous very vascular, loose connective tissue bands all of which were ligated, save a posterior one which held the tumor rather close to the back. This was clamped and the clamp allowed to remain for 48 hours when it was removed without incident. The tumor had no pedicle and was completely encapsulated. The wound was closed around the forceps and a gauze drain, protected by rubber dam.

The operation was begun at 8:30 and ended at 10:25. Administration of the anæsthetic was started at 8:15 and stopped at 9:55.

The patient was put to bed in a state of severe shock, which, in spite of active medication, continued for more than 24 hours. Twenty-four hours after the operation the blood pressure was 80–68 but the next day it had risen to 110 and the next to 144. All medication was discontinued after the eleventh day and the patient left the hospital on the fifteenth day. He has had no attacks during the 74 days since the operation, can lie on his left side with comfort, and has resumed his work.

The tumor was found to be quite regularly spherical in shape with a distinct, perfect capsule to which were attached numerous vascular tissue

[1]Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

Fig. 1. Photograph of capsular surface of tumor. Contour disturbed by bisection.

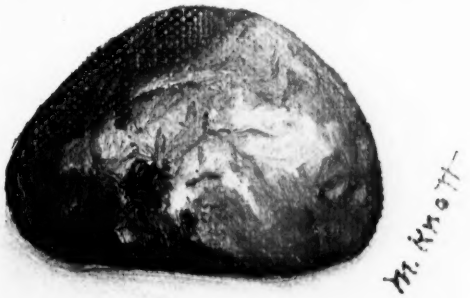

Fig. 2. Cut surface of the tumor. Actual size and shape. Texture quite well shown.

bands. It was firm, smooth, elastic, and gave to the palpating fingers the sensation of a tense cyst. Figure 1 is a photograph of the capsular surface of the tumor. The contour was disturbed somewhat by bisecting the tumor before this photograph was taken. Figure 2, which is reproduced from a painting of the cut surface of the tumor, shows the shape of the growth better and the texture also.

MICROSCOPIC PATHOLOGY

Half of the tumor was sent to Dr. J. Ewing of New York, and half to the pathologist of St. Joseph's Hospital. Dr. Ewing reported as follows: "The tumor which you sent me proves, on section, to be an aleveolar carcinoma. The main features suggest the diagnosis of adrenal adenocarcinoma. The cells are quite opaque and they form small, rather regular, alveoli (Fig. 3). There are no traces of pigment, so that the tumor is probably an adrenal cortical tumor. The structure is not unlike that of the renal cortex, but the fact that there are no luminæ shows that it is not a renal tumor. Although the tumor was well encapsulated (Fig. 4) and not of large size, I think it is malignant. There are many large blood sinuses through which the tumor cells might well produce metastases. Yet all these sinuses are intact and it seems quite probable that no metastases have occurred."

The hospital pathologist's report was as follows: "The specimen was brought to the laboratory on June 26, 1929. Microscopic study of sections from various parts of the tumor mass shows an extensive hyperplasia and overgrowth of the cortical tissue of the adrenal, especially the zona glomerulosa, extending from the capsule down for about 1 to 2 inches. The histologic architecture is that of numerous broad sheets of cells without any alveolar

TABLE I.—BLOOD PRESSURE READINGS DURING OPERATION

Time	Systolic pressure	Time	Systolic pressure	Time	Systolic pressure
8:30	.110	8:55	.228	9:17	.110
8:35	.110	8:57	.230	9:18	.128
8:40	.130*	8:59	.222	9:22	.114
8:41	.140	9:01	.218	9:23	.112
8:42	.152	9:02½	.225†	9:24	.110
8:42½	.160	9:06	.148‡	9:26	. 90
8:43½	.153	9:07½	.157	9:28	. 88
8:45	.184	9:09	.174	9:39	. 96
8:46½	.222	9:11	.228	9:43	. 80
8:48	.262	9:13	.232	9:44	. 78‖
8:49	.264	9:14	.206§	9:45½	. 82
8:53	.260	9:16	.162	9:48	. 86
8:54	.262				

*Patient cyanotic.
†⅙ grain morphine sulphate administered.
‡3 c.cm. digifolin administered.
§Tumor removed.
‖ Adrenalin administered.

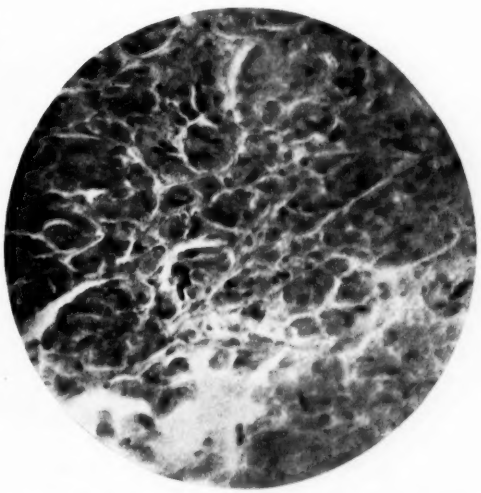

Fig. 3. High power photomicrograph of adrenal tumor removed.

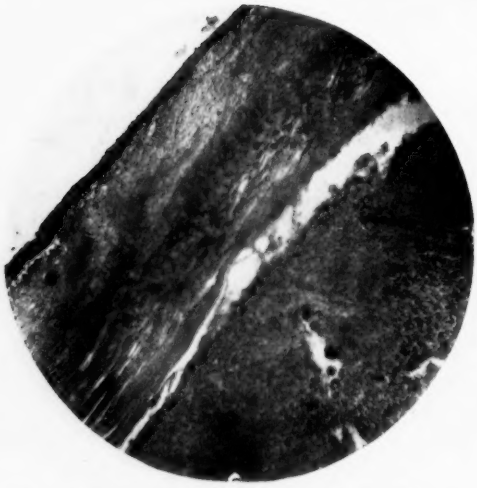

Fig. 4. Low power photomicrograph of adrenal tumor removed.

formation. The cells are arranged in small circular groups separated by fine strands of connective tissue. This arrangement of the cellular elements is uniform from the capsule down. The histological picture of the specimen is that of a neoplasm known variously as adrenal hypernephroma, Grawitz's tumor, or adrenal adenoma."

Prior to the present, 7 cases of paroxysmal hypertension have been reported, including 5 from Europe and 2 in this country. In 1 case the lesion was nasopharyngeal; in 1 case it was mediastinal; 1 case was due to a tumor like the one herewith reported; there was 1 case in which the etiology was not definitely determined; 1 case was due to meningococcus meningitis; and 1 was a paraganglioma. The case reported in the paper was an adrenal adenocarcinoma. It is worthy of note that of these 8 tumors causing paroxysmal hypertension, 5—possibly 6—were malignant. Another noteworthy fact is that 2 of these tumors were remote from the adrenal glands, i.e., above the diaphragm.

It would seem that tumors of the chromaffin organs in any situation may cause paroxysmal hypertension. So far as can be learned, in only 2 cases, that reported by Dr. Shipley and the one reported in this paper, were diagnoses made before operation. Malignant invasion of glands usually results in hypofunction rather than hyperfunction, but the reverse would seem to be the rule in chromaffin-cell tumors.

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LAWS OF CELL GROWTH[1]

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THE study of cell growth is most interesting, as is the study of all that is connected with the function of cells; namely, maturity, degeneration, and death. Disintegrative bacteria, as single cell chemists, were the first industrial workers; they split and resplit the inorganic elements making new combinations of the world's material. The one essential material was the chlorophyll in the cell which made active microbic life possible and, ultimately, multicellular life. Single cell life growing by division of the cell into two cells, under the influence of food and environment, is a normal process and continues thus indefinitely. These chemists prepared the way for higher types of active single cells to live on the organic material, which was accomplished when chlorophyll appeared. Cell growth is possible because the permeability of the cell membrane allows the cell to receive food; the single cells assimilate the food and eliminate waste products. They multiply indefinitely with food and favorable environment. Cell growth lags at times to start anew with an added drop of the original culture or by some change in fluid or cells developed by the rest period.

Recent work in the field of vitamins has disclosed the existence of significant relationships between various vitamins and processes of growth. Evans and his co-workers have shown the necessity for a fat soluble vitamin E for reproduction. Vitamin B has been shown essential for proper lactation, and the hormones of the gonads are known to be essential for normal development. All these results indicate that, although the nervous system may effect a proper relation of various organs, still the essential controlling mechanism in growth appears to depend on the presence of various vitamins and the products of the various ductless glands.

The great animals of past ages, both invertebrate and vertebrate, possibly lacked the control of cell growth and size, one factor which caused them to perish from the earth. The blue whale of today, 90 feet long and 150,000 pounds in weight has survived in the sea and is now the largest living animal. When the more advanced life of multicellular structures developed, the granules which had controlled the large single cell organisms became assembled into different organs for the general control of the body, making community cell life possible. The secretion of the cells then passed into the intestine to prepare nourishment or was delivered into the blood, by absorption or through lymphatic vessels, to act as fluid nerve hormones. They may be amplified by sympathetic ganglions with nerve connections causing change in the general circulation, the internal organs, or other regions of the body. At the present time, following ages of trial and adjustment, there is an average size to cells of both plants and animals. The laws of growth, with normal conditions, give an average size for all structures and organs made up of cells. The limitation of growth is a factor seldom considered except in the presence of cretinism, of gigantism, or of local overgrowth.

Riddle, at the thirteenth annual meeting of the Association for the Study of Internal Secretions held in Portland, Oregon, July 9, 1929, expressed the conviction that growth in the animal organism, in particular intrauterine growth, is not under the control of the nervous system, but that it is controlled by the ductless glands. Robertson has shown that growth progresses in definite cycles with various stages of retardation, which, when plotted, form a series of steps. P. E. Smith, by removal of the pituitary gland in the tadpole, showed that metamorphosis was prevented. The tadpoles grew to a very large size, but remained in the tadpole form. The administration of thyroid preparation at any time induced metamorphosis, but the thyroid gland of the hypophysectomized tadpole was in a quiescent state and did not appear to possess the power of activity. In 1919, Uhlenhuth suggested that the mechanism of

[1]Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

Fig. 1. Growths on grape leaf caused by sting of phylloxera.

metamorphosis involved the thyroid gland and another substance which acted as an excretory material and induced the gland to pour out its secretion, thereby producing metamorphosis. In 1929, Schwartzbach and Uhlenhuth showed that the anterior lobe of the pituitary gland is the source of the excretory substance. The thyroid gland can be stimulated by the administration of this substance. These results explain Smith's observations that the removal of the pituitary gland resulted in loss of activity of the thyroid gland and prevented metamorphosis. The administration of extracts of the anterior lobe of the pituitary gland produces gigantism. It would seem, therefore, that the pituitary and the thyroid glands have a controlling influence on certain phases of growth.

The cretin is a child or an adult person who was born without a working thyroid gland: a small, square-headed, dry-skinned, unintelligent human animal who, if fed thyroid gland or its active principle, thyroxine, during the early years of life will grow both mentally and physically. Myxœdema is the condition which develops in persons whose thyroid glands have become inactive in adult life. Oversecretion of the posterior lobe of the pituitary gland causes delay in the development of sex structures, with a continuation of the infantile period of life, whereas local or general overgrowth of the body is associated with changes in the anterior lobe of the pituitary gland. This region of the gland apparently stimulates the thyroid gland to activity.

The first crossing of selected stocks of cattle of long heredity, like the Aberdeen Angus bull with the Holstein, increases the rapidity of growth and weight over either type during the first 15 months of life. The first crossing of Rhode Island red chickens with barred Plymouth Rock chickens gives more rapidly growing progeny, with greater weight and greater egg fertility. This is true, also, of growth with artificial cross-fertilizing of fruits and berries. The condition is maintained by planting grafted stock. Burbank proved this by his development of cross fertilization.

Overuse increases muscular development, and hypertrophy results. Intermittent pressure develops overgrowth of bone, as seen in bunions. The epithelium of the hands and feet, by rough wear, produces calluses as additional protective layers of cells are formed. The demands of the body for the function of certain organs cause hyperplasia of the cells. Thus, iodine deficiency changes the thyroid gland to a hyperplastic gland. The liver, also, through demands of the body as a stimulus, has great power of regeneration. If 70 per cent of a dog's liver is removed it will regenerate in 8 weeks, the growth being from the remaining part, not from the new. The uterine muscle undergoes a great increase during pregnancy, which is caused by the chemical reactions of pregnancy, whether the pregnant ovum is in the uterine cavity, is in the tube, or has slipped out into the abdomen.

Beginning 3 years ago, for a period of 2 years, when a uterus containing fibromyomata was removed, the portion containing small tumors was sent to Rosenow, who made cultures of the crushed and ground tissue and secured bacterial growths of diplococci in 60 per cent of the specimens. In the uterine muscle a clump or colony of such bacteria, the chemical product of which locally resembles that of pregnancy, causes the development of

fibromyoma of all muscle within reach of their influence. Degrees of resistance by irritation add connective tissue and a fibromyoma of local uterine muscle results. Epithelial cell growth, as a wart or papilloma, may be induced by clumps of specific bacteria.

Destroying the so-called grandad wart destroys the focus and all the other warts. Local deposits of special bacteria in a mucous membrane base may cause polyps or papillomata, as in the mouth, larynx, rectum, bladder, or renal pelvis. Larger areas within the uterus cause endometritis, or in the bowel typhoid fever exfoliation, as in colitis or polyposis. Undoubtedly, many carcinomata of the mucous membrane are secondary to local irritation of small growths. The irritation may have varied causes, as the condition is understood today.

The oldest living cells in the world are such cells as those in the giant trees of California, three thousand to thirty-five hundred years old.

The average length of life is increased, yet in the past ages individual men lived just as long as they do today.

The cells have, then, a period of growth under control, maturity, and senescence which terminates in death. Sir John Bland-Sutton said that at death of persons 90 or more years of age, a very high percentage of carcinoma should be found by a careful search. Years ago I wondered at Cohnheim's theory of tumors developing from misplaced embryonic cells. These tumors have one of the essential conditions of cell division—stimulus from non-function. With growth started, all the results of their oxidation go to cell division. The cell division occurs in the non-functioning cell with less cytoplasm about the nucleus than that of normal cells. This makes the nucleus look proportionally larger. Such conditions are essential to cancer.

The number of unsuspected symptomless carcinomata found in carefully made necropsies is surprisingly high, but with poor circulation, abnormal change in harder and less active cells is slow to start and remains long a local condition, as in the aged. This makes doubtful the value of chemical reactions of the blood, such as we had hoped would enable us to detect the presence of internal cancers in their early stages. Often slight, local skin growths are found; they are seldom active enough for treatment until friends or relatives complain of their apparent neglect. At the great animal slaughter places, tumors are not uncommon in even comparatively young slaughtered animals which are usually under the age limit of natural cell degeneration.

Fig. 2. Rose gall.

In the garden and woods, we see the stimulus of the chemical juice of female insects on leaves, such as on the grape vine when it is stung by phylloxera (Fig. 1). The galls on rose stems (Fig. 2) are tumors. Plant carcinomata of special galls described by the late Erwin F. Smith may be created by special chemical injection or by injecting the bacillus tumefaciens into the plant's circulation. Smith applied the description of cell growth in carcinoma, as made by well known pathologists, to the crown gall cell growth, and it was a perfect description of the cell change.

Like a heat regulator, we have a definite control of cell growth, also of the numbers of

red and of white blood cells, of the quantity of blood and of the calcium and blood glucose. An increase or decrease of these normal blood constituents constitutes ill health which may not be early appreciated.

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THE TONSILS AND SOME EXPERIENCES OF THEIR SURGICAL TREATMENT[1]

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IT may seem strange to you that having been given the whole field of otorhinolaryngology from which to choose a subject for my address, I should select one so commonplace, threadbare, and even risky as anything to do with the tonsils. I say "risky" because one might visualize many of your Fellows bringing their own self-designed and foolproof guillotine "which enucleates the tonsil complete in its capsule" and, needless to add, the operation would be a bloodless one. Since my arrival in your hospitable country, I have heard used the term "tonsil kings" but no definition of this human species having been forthcoming, I have had to draw my own conclusions. If any such potentates be here today, I must ask their forgiveness if the mechanical aspect of tonsil surgery finds little place within the compass of my short address.

AN ANATOMICAL MISNOMER

The term "supratonsillar fossa" is often used when matters connected with the tonsils are being discussed. Since that potential space is lined with epithelium, contains more or less loose lymphoid tissue, and is within the capsule of the tonsil, it would be more correct if we dropped the Latin prefix and simply spoke of the "tonsillar fossa."

SOME SURGICAL ASPECTS OF DEVELOPMENTAL ANOMALIES

On occasion some developmental anomalies may become surgically important, and probably there are several of you here who have been hindered during a tonsil operation by an unduly long and ossified stylohyoid ligament. I have not known it to prove a serious complication, because by separating and pushing outward the surrounding gland and connective tissues, the projecting bony spine can easily be divided with forceps and removed.

Less commonly we may meet with the isolated spicules of bone or cartilage. The large majority of these are, in the opinion of the late Professor S. G. Shattock, embryonic "rests" of the branchial arches.

I would like to take this opportunity of showing you a unique specimen of a bony tumor or "osteoma" which bulged forward the left soft palate and invaded the corresponding tonsil so that only a small portion of this remained in the lower end of its recess.

I saw the patient when she was 5 years of age, and it was agreed to wait until she was older before attempting its removal. I did not see her again for 25 years, when she consulted me because the tumor was ulcerating through the soft palate and by scraping the side of the tongue made it sore. A crucial incision over the area of ulceration and separation of the surrounding soft tissues allowed easy enucleation of the osteoma. It was as large as a walnut and measured 1½ inches in its long diameter.

Its pressure on the cartilaginous portion of the eustachian tube had destroyed the median half of that structure without producing any ear symptoms. So rare was such a specimen that not even Sir John Bland-Sutton, with his unrivaled experience of developmental curiosities, had seen anything like it, and the late Mr. Howard Mummery at first glance thought it suggested an odontome. He ground down many sections and reported that it contained no dentine but that sections of its fibrous capsule showed the presence of bone and cartilage deposits.

Professor Shattock then carried out a long and patient research on the nature of the tumor and his full and admirable report on it you will find in the *Journal of Laryngology and Otology* for April, 1924. It was included there by Dr. Irwin Moore in his exhaustive contribution on "Osseous and Cartilaginous Formations in the Tonsil."

It will suffice now to say that the tumor was composed almost entirely of compact bone.

[1] Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

TONSILLAR CALCULI

Although tonsillar calculi are neither osseous nor cartilaginous in structure, one may refer to them before passing to other matters, because attention has just been drawn to the occasional presence of bone and cartilage in tonsils.

Calculi may vary in size from that of a millet seed to that of a bantam's egg and may weigh as much as 1 ounce. Their composition is mainly phosphate and carbonate of lime and magnesia.

They may cause pain in the tonsil on deglutition and tend to produce attacks of tonsillitis, but my reason for mentioning them at all is this: if a small calculus be hidden in the tonsil and give rise, as it often does, to neuralgic pains in the depth of the aural meatus the causation of this symptom may easily be overlooked. Not infrequently I have seen the condition diagnosed as a "gouty" or "rheumatic" throat with consequent ineffective and possibly expensive treatment, especially when this involved a prolonged stay at a fashionable spa.

There should be no particular difficulty in establishing the presence of a calculus in the tonsil because the latter is generally redder than its fellow and pressure on its anterior surface causes pain. A blunt probe passed into the tonsillar fossa or into some of the upper lacunæ will rarely fail to detect the rough surface of the tonsillolith.

Small ones can easily be removed by a small hook or spud, the larger ones may have caused such a degree of tonsillar inflammation and sepsis that enucleation of the whole gland will be the best form of treatment.

SURGERY IN ITS RELATIONSHIPS TO THE FUNCTIONS OF THE TONSILS

It is generally held that whatever else may be the functions of the lymphoid constituents of Waldeyer's ring, their protective rôle is the most important of them. But curiously enough the textbooks seem to have omitted one argument which Nature herself frequently proclaims, and her proclamation may often be read on the walls of the oropharynx—but do we always grasp the meaning of her message?

It must frequently have fallen to our lot to be consulted by young adults whose tonsils had been enucleated when they were young children. What do we sometimes find when they consult us later in life? A hypertrophied, somewhat œdematous band of congested mucous membrane corresponding to the so-called "lateral pharyngeal band." Or it may be several large patches of granular pharyngitis on the posterior wall. We may also be surprised to find that, in spite of our enucleation of "the tonsil complete in its capsule," there has appeared a considerable mass of lymphoid tissue in the lower halves of the tonsillar recesses. What do these appearances mean? To me they signify that Nature insists on having some lymphoid tissue in the oropharyngeal and nasopharyngeal regions and if it be too radically removed in a child, it may be replaced where it is required. That so-called "recurrent tonsil" may not be what our operation left behind, but lymphoid tissue pushed upward from the side of the lingual tonsil.

If such observations and their explanation be correct, what practical inferences are to be drawn from them? Is our tonsillar surgery sometimes too drastic? Are there any means by which we can foretell when such compensatory developments will occur? I ask these questions because I have seen, and have had to operate on, chronically inflamed lateral pharyngeal bands as large as an ordinary lead pencil. They had caused much pain when they became acutely inflamed.

Let me bring to your attention one other consideration, and this of ethical bearing. When we meet with these compensatory adjustments in the possibly aggrieved patient of a colleague, let us remember that of "Faith, Hope and Charity, the greatest of these is Charity."

SURGERY IN ITS RELATION TO THE TONSILS AS PORTALS OR CARRIERS OF INFECTION

It is obvious that on this time-limited occasion one can only touch on the general principles which this subject involves. We are all familiar with the acute tonsillitis which often heralds the onset of such acute specific fevers as scarlet fever, acute rheumatic fever, and, not infrequently, diphtheria.

We know that the tubercle bacillus, in more stealthy and less dramatic form may invade the tonsillar tissues, pass through them, and cause a tuberculous adenitis of the cervical glands, and do so without causing any macroscopical changes in the tonsil itself.

We have also reason to believe that certain types of arthritis, myositis, neuritis, and other aural, ocular, cardial, and distal manifestations of sepsis may be primarily of tonsillar origin.

For the few moments at my disposal it is only possible to make some brief statements on the most important of these infections.

1. *Diphtheria.* It has been my experience to cure quickly some otherwise intractable diphtheria carriers by enucleation of the tonsils which on bacteriological examination revealed the Klebs-Loeffler bacilli in the crypts. One patient had been isolated for 6 weeks after convalescence, another for 9 weeks. Both of them appeared to be in perfect health and were anxious to take up their ordinary work.

2. *Tubercle.* A vast amount of work and investigation has been carried out on the subject of tuberculous infection of the cervical glands by way of the tonsils.

My personal and purely clinical experience supports the contention that true tuberculous infection of the tonsils is not common and occurs in not much more than 5 per cent of the cases. It would appear that enlargement of the tonsils is primarily due to pyogenic organisms, and that these bring about the cervical adenitis which later on becomes infected by the tubercle bacillus. This would explain why enucleation of the tonsils is so often followed by the gradual disappearance of the glands in the neck, provided they have not already begun to break down and suppurate.

If such a contention be correct, it follows that the earlier septic tonsils are removed, the better will be the prognosis with regard to the cervical adenitis and tuberculous infection of the glands. To those who are interested in the subject, I would suggest reference to monographs by Howarth and Gloyne[1] and by Ritchie Paterson.[2]

[1] J. Laryngol. & Otol., 1924, Aug.
[2] J. Laryngol. & Otol., 1929, Aug.

3. *Chronic arthritis.* It will generally be conceded that, in the absence of definite bony changes around the joint articulations, the removal of septic tonsils will cure or give considerable relief in about 50 per cent of the cases. In this matter I have seen some very gratifying results, but equally disappointing failures, and must confess that, so far, I know of no definite clinical signs on which to base a prognosis. Suffice it to say, that enucleation of septic tonsils seems to promise a good result if the history of the patient shows that an attack of tonsillitis is followed by aggravation of the joint symptoms and also if, in the quiescent periods, the anterior faucial pillars are of a purple red color.

This appearance generally indicates that the "streptococcus viridans" is the offending organism.

But we must not forget that disorders of metabolism might, if corrected, relieve a large percentage of the cases which tonsil enucleation has failed to alleviate. If time permitted, this aspect of the subject might profitably be discussed.

But one of our most important problems seems to lie in the attitude which we as surgeons should adopt in cases of acute rheumatic infection. Let me give you only two examples of the many difficulties which so frequently confront us.

1. A child suffered from a cardiac lesion following immediately upon an attack of acute tonsillitis. After 3 months' convalescence, I enucleated the tonsils. A fortnight later she was readmitted with some pericarditis, and eventually she left the hospital a cardiac invalid.

2. A girl, aged 13 years, with enlarged tonsils, had suffered from sore throats. Then there supervened an attack of acute rheumatism with mitral disease from which she made a good recovery. Three weeks later the tonsils were enucleated, 3 days after the operation the temperature rose, and a dangerous and nearly fatal carditis and pericarditis rapidly developed.

Now arises the problem: Were these patients directly inoculated by the micrococcus through the raw surfaces exposed by operation while their susceptibility to infection was still high?

I quote these two cases from the Lettsonian Lectures "On Rheumatic Heart Disease in Childhood"[1] delivered by my friend and hospital colleague, Dr. F. J. Poynton. As you may know he and Dr. Paine in 1899 and in the earlier years of this century were the first to establish, by animal experimentation and clinical observation, the streptococcal origin of rheumatic infection.

The cases I have cited prompt at least two questions: (1) When do the tonsils lose their protective function and become a source of danger? (2) How are we to determine when convalescence from an attack of acute rheumatism is so complete that we may safely remove diseased tonsils in order to prevent or minimize the chances of a further attack? I hope some of you will be able to answer these questions.

Poynton asks (*loc. cit.*) a question which we must often have asked ourselves, viz.: "A child has an attack of rheumatism with evidence of tonsillitis; there is apparent recovery, the tonsils seem healthy, and the tonsillar glands are enlarged to a slight degree or not at all. Ought or ought not we to advise their removal as a precautionary measure? If we feel that we should do so, should we operate at the end of the acute illness, or should we wait until the child has made a thorough convalescence?"

It would be very interesting to hear your experience as to the occurrence of first attacks of rheumatism in children who have already had their tonsils enucleated. If it be frequent, then we must be more careful in the selection of cases for surgical treatment.

MALIGNANT DISEASE OF THE TONSILS

Primary carcinoma and sarcoma are the two commonest forms of malignant disease of the tonsils, and I refer to these lesions only because on a few occasions patients have presented themselves with a mass of hard glands behind the angle of the jaw and no primary lesion could be seen in the throat or nasopharynx. But on enucleation of the tonsil and microscopic examination of the sections, the small and unsuspected primary growth was found.

[1]Tr. Med. Soc. Lond., 1928.

An analogous but more obvious condition is sometimes seen in the tongue, viz., a small primary growth and a large mass of glands or, conversely, a large fungating ulcer with very small metastases in the cervical nodes.

With regard to the treatment of the primary growth in the tonsil, radiotherapy seems to have completely ousted cutting operations and diathermy. One need scarcely say that small doses of the screened element, or of its emanations, are inserted in and around the growing margin of the tumor and left for from 5 to 8 days. Infected glands in the neck are removed by a block dissection either before or after radiation of the tonsil lesion, and the affected triangles in the neck are given further exposures from time to time.

The increasing frequency of the good results of such treatment must surely be among the triumphs of modern medicine.

POSTOPERATIVE COMPLICATIONS OF TONSILLECTOMY

Hæmorrhage. An experience of 33 years seems to me to have proved that hæmorrhage is the most frequent accident following removal of the tonsils, and the one most feared by the patient if he or she be an adult, or by the parents in the case of their child. If one visualizes for a moment the anxiety which such a complication may cause, the possible necessity for a second anæsthetic in order to secure one or more bleeding points, the alarming degree of anæmia which may quickly result, and the prolonged convalescence to normal health, we may well ask ourselves the question, "Do we always sufficiently prepare our patients for this operation and in carrying it out do we endeavor by proper surgical measures to minimize the risk of postoperative bleeding?"

To go into lengthy answers to these questions is impossible and I can only briefly state my own views and practice. For some 15 years, I have enucleated all tonsils, in private practice and in hospital, by dissection. Previous to that period I used the guillotine method as introduced by Whillis, Pybus, and Sluder, and by keeping a careful record of all cases from infancy to old age (my oldest patient, aged 72 years, suffered from 3 to 4

quinsies a year), found that my cases of bleeding which required active intervention were about 5 per cent. Since I employed dissection they have been reduced to 1 per cent.

I believe the reduction may be explained in two ways: (1) by the well known physiological fact that the torn or lacerated end of an artery contracts and retracts more readily than if it be cut or divided by a more or less sharp instrument; and (2) in every patient from the youngest to the oldest, I ligate the descending branch of the posterior palatine artery and if necessary the tonsillar branch of the facial in the lower region of the tonsil recess. Furthermore, no patient is allowed to leave the operating table until the tonsil beds are dry.

The time required for such operative details is rarely more than 10 to 12 minutes. Compared with the guillotine method, dissection takes longer, but stopping all bleeding demands less time so what "we lose on the swings we can make up on the roundabouts."

For years I have preached the advisability of ligating, but at first my voice was "as of one crying in the wilderness"; today I am glad to say that this practice is becoming more universal, at any rate in England. To place a ligature securely round an actively bleeding vessel requires possibly from 5 to 6 seconds, and the operator leaves the home or hospital with his mind free from any anxiety. When surgeons write in the journals or tell me that they check operative hæmorrhage by pressure with gauze swabs, I would ask them two questions: (1) Why do you do for the tonsil recesses what you would not do in the case of a bleeding artery in any other accessible part of the body? (2) How do you know that there will not be some postoperative vomiting, crying, or restlessness, and that the strain of these will not re-open the unsecured end of a small artery?

I know it requires considerable practice and some little dexterity to recognize and tie the chief arteries which supply the tonsils, but surely it is our bare duty as experts to attain some particular skill in our craft, otherwise wherein lies the *raison d'être* of our calling? Nevertheless, however careful we may be in the preparation of our patients and in the technique we adopt, an occasional postoperative hæmorrhage will prove that we are but human and our methods fallible. About 12 months ago I enucleated the fibrous tonsils of a man who was subject to recurrent quinsies. The hæmorrhage was so excessive that I ligated 7 bleeding points and the tonsil beds were dry when he left the operating theater. Four hours later hæmorrhage recurred and, before I could get to him, he was pulseless at the wrist, exsanguinated, and begging in a whisper for "more air." Intravenous saline injections, stimulants, and the removal of clots from the tonsil recesses stopped the bleeding and he recovered. Fortunately such experiences are rare and they should continue to be so but only if we employ the first rule of surgery in checking arterial hæmorrhage, viz., to seek for the bleeding point and ligate it.

I know no other method by which we can discharge the responsibility of doing our best for the safety and sanctity of a life entrusted to our care.

PULMONARY COMPLICATIONS AFTER TONSIL OPERATIONS

Of pulmonary complications after tonsil operations, it has been my good fortune to have had practically no experience in my own practice nor have I seen such cases in consultation with my colleagues. Sir St. Clair Thomson makes a similar personal statement in the last edition of his book on *Diseases of the Nose and Throat.*

It is therefore impossible for me to discuss a complication from which we seem to be relatively immune in England.

From your literature on the subject I gather that you consider that severe pulmonary complications may arise from direct inhalation of septic material which is liberated at the time of operation on the tonsils, or from septic thrombosis of the veins in their "recesses" which lead to the formation of pulmonary emboli.

I do not know in which position you place your patients during enucleation; ours generally have the head extended by means of a sandbag under the shoulders, so that all blood and secretions pass into the nasopharynx and cannot get into the lower air passages. Again,

we never adopt the sitting or semiprone positions; no pillow is allowed in the bed until the patient has recovered the cough and swallowing reflexes. Finally, obvious dental sepsis is treated before the tonsils are operated on.

And now I have only to thank you for so patiently listening to me while I have tried to discharge the honorable task you invited me to undertake.

Like the song of Nanki Poo in "The Mikado," my contribution to your proceedings has been, I fear, "a thing of shreds and patches," little experiences and thumbnail sketches drawn from a pilgrimage of 33 years, but if any of them have interested you or stirred your imagination I shall, indeed, take away with me a most abundant and satisfactory reward.

RADIOLOGY AS A COMPLETE OR PARTIAL SUBSTITUTE FOR SURGERY IN TREATMENT OF CANCER OF FEMALE PELVIC ORGANS[1]

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FIVE years ago I had the honor to submit before this distinguished Society at its Congress in New York the results obtained at Radiumhemmet in Stockholm with the radium treatment of carcinoma of the uterine cervix.[2]

During the last 5 years our conception of the interrelationship between surgery and radiology in the treatment of cancer of the female pelvic organs has been clarified on many points. Our ability to decide in what type of case one or a combination of both methods should be used has been considerably enhanced. It is my intention in this paper to present to you the views which our experience at Radiumhemmet has led us to adopt in this regard.

CARCINOMA OF THE CERVIX

The number of cases of cancer of the cervix radiologically treated and followed up for 5 years is sufficiently great to allow positive conclusions to be drawn from a statistical comparison between the results obtained by radiotherapy and those obtained by surgery. This, however, holds good only for a comparison of the figures for the so-called absolute cure rate, i.e., the number of cured cases 5 years after the treatment, expressed as a percentage of all cases presenting themselves.

In 1927 I made a careful computation of the results obtained by operative treatment[3] comprising all the statistics published in the literature of the world, from which the absolute cure rate with the extended operations could be exactly deduced.

In Table I these results will be found compared with the results obtained at Radiumhemmet by radiological treatment.

It will be clear from Table I that the absolute cure rate for surgical treatment, estimated on 5,806 cases, of which about 54.6 per cent were operable, is 19.1 per cent.

The rate of cures obtained at Radiumhemmet in 1914-1923 in 790 cases treated radiologically, of which 25.5 per cent only were operable, is 20.6 per cent.

It should be noted that in the statistics of Radiumhemmet are included all cases of carcinoma of the cervix primarily treated by radiology, also those in which the patients have had only a single application for palliative purposes or on humanitarian grounds and those in which the patients have interrupted the treatment. In addition are included 53 patients, who partly on account of lack of accommodation could not be admitted.

Despite a considerably less promising, initial material our results are as good as, or even slightly better than, those obtained by surgery. The latest statistics, among others those of Menge in Heidelberg and of Ward in New York, show results similar to those of Radiumhemmet. There would seem to be no doubt, therefore, that by a properly carried out radiological treatment of cancer of the cervix one should be able to obtain at least as good results as by operation, so far as absolute cure is concerned.

The comparison of the absolute cure rates is the only reliable method of estimating the results. All other methods will involve a greater or less degree of ambiguity.

A comparison, for instance, of the results obtained in operable cases alone is less reliable

TABLE I.—THE ABSOLUTE CURE RATE IN THE TREATMENT OF CARCINOMA OF THE CERVIX

	Surgical treatment Literature of the world	Radiological treatment Radiumhemmet 1914–1923
Cases examined	5,806	790
Cured	1,111	163
Absolute cures, per cent	19.1	20.6
Average operability per cent	54.6	
Operable cases per cent		25.5

[1] Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929

[2] In this paper cancer of the cervix is used instead of cancer of the collum of the uterus including both cancer of the cervix and cancer of the vaginal portion.

[3] Acta Radiologica, 1927, vol. iii.

TABLE II.—THE CURE RATE IN OPERABLE CASES OF CARCINOMA OF THE CERVIX

	Surgical treatment Literature of the world	Radiological treatment Radiumhemmet 1914-1923
Cases treated.....	3,659	188
Cured.....	1,303	76
Percentage cured....	35.6	40.4

for several reasons of which the following are the most important:

1. The number of so-called operable cases in the radiological statistics is still relatively small.

2. The conception of operability varies widely with each individual investigator. During the visit of the American Gynecological Club to Radiumhemmet in 1926, I demonstrated our therapeutic technique in a case of cancer of the cervix which I held to be a border-line case. Reuben Peterson, Joseph Brettauer, and George Gray Ward, unaware of my classification of the case, examined the patient at my request. Of these three gentlemen, one considered the case operable, another thought it a border-line case, and the third felt inclined to look upon it as inoperable. This episode illustrates how, even among experts, the idea of operability may vary.

3. The statistics of operable cases, treated radiologically, include all cases which on clinical examination have been considered operable. The corresponding group of the surgical statistics, on the other hand, excludes those cases which, it is true, the surgeon considered operable before the operation, but which at operation he found to belong to the inoperable group. Such cases undoubtedly occur not infrequently. In Weibel's statistics[1] they amount to 10 per cent, and in a series of 33 cases operated upon and referred to us for after-treatment, this was found to be the case in more than 12 per cent.

The relatively small number of operable cases in radiological statistics, as well as the above-mentioned possible irregularities in the initial material, compels us to be careful in arriving at conclusions.

In a comparison such as this (Table II), however, the superiority of radiological treatment in operable cases seems to be rather more pronounced than is the case in a comparison of the absolute cure rates.

[1]Arch. f. Gynaek., 1928, CXXXV, 1.

The results submitted by Ward, Schmitz, and Regaud, among others, point in the same direction.

In these comparisons no regard has been paid to factors in favor of radiological treatment, such as: (1) a lower primary mortality (1 to 2 per cent as against an average of 15 per cent by operation), (2) a reduced morbidity, and (3) considerably less discomfort for the patient.

On the strength of the evidence presented above it seems to me that in the future the radiological treatment is likely gradually to replace extensive operations, as the method of choice in the treatment of cancer of the cervix.

As a matter of fact, this has been the rule in Sweden since 1920 when Radiumhemmet presented its first 5-year statistics to the Swedish surgeons. At the suggestion of Forssner and Essen-Möller, Swedish surgeons concluded to submit their operable cases to radiological treatment. Since 1920, only a small number of operable cases have been operated upon in Sweden.

It is obvious that a change from operative to radiological treatment is possible only when and where the necessary conditions for successful radiotherapy are available. Where this is not the case, radiological treatment cannot attain results comparable to those of surgery, especially those obtained by the skillful masters of surgery, in whose hands the results of extended operations are better than is indicated by the average figures submitted.

Yet it seems to me that the growing generation of young surgeons, who have not had the time to acquire the dearly bought technical skill and judgment of their masters, is less likely to make use of extended operations. As the availability of thorough radiological treatment increases, the extended operation for cancer of the cervix will tend to become less and less frequent.

It has been suggested that operation should be confined to the earliest cases, and that, in order to reduce the primary operative mortality—one should be content with the performance of a simple hysterectomy followed by postoperative, radiological treatment. In our opinion this form of combined treatment is not the most promising.

Out of 24 early cases operated upon during the period from 1914 to 1924 and referred to us for radiological after-treatment, 11, i.e., 45.8 per cent, lived 5 years after the operation. This recovery figure is only slightly higher than that of Radiumhemmet for all the operable cases and yet the primary operation mortality has been entirely left out of consideration. The recovery figure is considerably lower than the result we obtained in a similar series of 43 early cases in which we had 62.8 per cent of cures. We have a series of 9 very early cases, 1926 and 1927, which were referred to us for treatment after operation. The fact that recurrences have appeared in one-third of these within 2 years will seem to support our opinion.

Regarding other forms of combined radical operation and radiological treatment, our experience is very limited. We have tried pre-operative irradiation in only 6 cases (4 operable and 2 inoperable). Five of these patients died of cancer within 1 year of the operation; 1 patient only, a very early case, has been alive, free from recurrence, for more than 8 years.

In certain cases of cancer of the cervix in which radiological treatment has failed, operation must be tried as a last resort. This applies to cases of incomplete disappearance of the growth or of local recurrences after radiological treatment.

In the course of 15 years we have tried operation after radiological treatment in a total of 50 cases: 39 cases for local recurrence or incomplete disappearance of the growth; 3 cases for recurrence in the fundus; 2 cases for recurrence in the glands; 6 cases of pre-operative irradiation (mentioned above).

The operation could be radically performed in two-thirds of the cases (30 out of 47; 3 supravaginal amputations not included); 17 cases proved to be inoperable; the operation was not made difficult by the preceding radiological treatment in any of the 47 cases; some difficulty in separating the bladder from the cervix was encountered in one-fourth of the cases.

The primary operation mortality was 16.2 per cent (6 of 37; 3 supravaginal amputations, 10 exploratory laparotomies not included).

The recovery was uneventful in two-thirds of the cases (21 of 31; 3 supravaginal amputations, 10 exploratory laparotomies, and 6 primary deaths not included).

The results show that of 32 cases operated upon more than 5 years ago, 8 are alive, i.e., 25 per cent, or, if 2 supravaginal amputations are deducted, 23.3 per cent.

Carcinomatous glands were found in nearly 50 per cent of those cases in which no glands were palpable at examination; in one-third of the 30 radical operations carcinomatous glands were removed; 6 cases radically operated upon with removal of carcinomatous glands have been under observation for 5 years or more after the operation; of these 2 are alive and free from recurrence 1 case 15, the other 6, years after operation.

CARCINOMA OF THE BODY OF THE UTERUS

To estimate the prognosis in cases of cancer of the body treated operatively or radiologically is at present exceedingly difficult. I wish to mention only two of the most important reasons for this.

1. Cancer of the corpus as compared with cancer of the cervix is in most parts of the world a relatively uncommon condition. The material available to the surgeon or the radiologist must therefore be relatively limited and is really as a rule too small for statistical computations.

2. The microscopical diagnosis is in a good many of these cases exceedingly difficult for the pathologist. When in doubt many pathologists prefer to report cancer and most operators in such a case would probably prefer to remove the uterus, thus giving the patient the benefit of the doubt. If, moreover, the resected organ has not been very carefully examined, it may very well happen that one or another case may have been included in the statistics that on more careful scrutiny should perhaps have been left out. It may be that in the individual statistics it is only a question of 1 or 2 cases; nevertheless, these are apt very considerably to influence the estimation of the final result in these small statistics which are mostly based on about 25, rarely on as many as 50, treated cases. Our experience at Radiumhemmet confirms this fact.

The microscopical diagnosis in a proportion of our cases was not made by our pathologist,

but we had to rely upon the statements of the referring physician. In some we did not even get a detailed pathological report. With the view of getting our cases of cancer of the body uniformly classified we have tried, for the last 12 months, to collect and revise all the figures. In this revision, we have found it necessary up to the present to exclude entirely 3 of our 31 cured cases, the absolute cure rate thereby being reduced from 43 to 39 per cent.

The relatively small percentage of operable cases in our statistics and the large percentage of similar cases in the surgical statistics make it impossible to use the absolute cure rate as a standard of comparison. We still maintain that operable cases of cancer of the body should be treated surgically and, as a consequence, have had mostly inoperable cases referred to us. In addition to these we also receive a number of so-called technically operable cases, by which we understand cases in which operation is contra-indicated because of technical difficulties or general conditions. Each of these groups represents one-third of all cases.

The subjoined table will show a comparison between the operative results collected from the world's literature and the revised results of radiological treatment of operable cases alone at Radiumhemmet (technically operable cases included).

TABLE III.—THE CURE RATE IN OPERABLE CASES OF CARCINOMA OF THE BODY

	Surgical treatment Literature of the world	Radiological treatment Radiumhemmet 1913-1923
Cases treated.....	323	52
Free from recurrence...	190	28
Percentage cured.....	58.8	50

It would seem from this table that operation in operable cases of carcinoma of the body is to be preferred to radiological treatment. In regard to the small number of cases, however, the comparison cannot be considered valid as long as we do not know whether the rigid standards regarding the histological diagnosis used at Radiumhemmet have been applied to the surgical statistics.

A larger series of cases providing a more accurate description of the histological condition is essential both for operative and for radiological statistics. Until such material is available, hysterectomy should be the method of choice in the treatment of uncomplicated operable cases of carcinoma of the body.

With radiological treatment, one should be able gradually to gain the necessary experience in the border-line cases. Among these exists a relatively large group in which, on account of general conditions and above all on account of technical difficulties caused by adiposity, an operation though not contra-indicated is less advisable. In making the choice between operation and irradiation in these cases, I have in recent years tried to individualize the treatment, always bearing in mind the clinical aspect of the uterine cavity.

As radiological treatment in carcinoma of the body has in some places yielded worse results than in cases of carcinoma of the collum, one has felt inclined to conclude that radiotherapy would be less efficacious in cases of adenocarcinomata. The correctness of this conclusion seems questionable. To me it seems just as likely that the cause is to be found in technical difficulties met with in the treatment of carcinoma of the body.

In a relatively large number of cases of cancer of the body of the uterus we have to deal with a dilated and irregular uterine cavity. Into this we must introduce a radium-container small enough to pass through the dilated cervix. It is reasonable to assume that in many cases small or large areas of the growth may fail to come in close contact with the radium-container. That this is so would seem to be borne out by our observation of cases operated upon after radiological treatment. For not infrequently one finds that the growth has completely disappeared in the lower part of the body where the cavity is narrow, while a small remnant of the growth will be found in the excavated area of the upper part because that has been farther away from the source of radiation.

We individualize the treatment in the border-line cases in the following manner: in cases in which the uterine cavity is narrow and of regular contour, and in which, therefore, one could expect a more uniformly close contact between the radium-container and the uterine wall, the patient is irradiated and kept under frequent observation. Nothing is done as long

as improvement proceeds. If after a period of temporary improvement new symptoms arise, i.e., hæmorrhage, discharge, or increase in size of the uterus, hysterectomy is done.

On the other hand, if the uterine cavity is irregular and enlarged, I prefer to operate and irradiate afterward. If in such a case great technical difficulties in operation exist, I have first treated by irradiation and then performed the more easily executed supravaginal amputation. By the pre-operative radiation I think I have decreased the risk of leaving a vaginal stump.

On the strength of our results, however, we consider ourselves justified in applying the same procedure even in operable cases, provided the patient consents to be placed under careful observation. Should the radiological treatment not be successful—which as a rule becomes evident after from 3 to 4 months—operation should immediately be performed. There need be no fear of any technical difficulties in an abdominal operation because of the previous radiological treatment, nor does the postponed operation, so far as we have been able to judge, incur any greater risk of spread of the carcinoma.

Our experience with such a combined surgical and radiological treatment is as yet too small, and the time too short, to permit of any conclusions regarding the results. Of 8 cases operated upon after radiological treatment before 1924, 2 are alive; 1 of these has been well for the last 9 years, and the other for 6 years; 1 died of intercurrent disease and another died of cancer more than 5 years after the treatment. In the period from 1919 to 1927, we have operated upon 22 cases altogether. Of these 12 are alive and free from recurrence 1 to 8 years after operation.

Naturally the inoperable cases of cancer of the corpus ought to be submitted to radiological treatment. The results are, even in regard to the outlook for a 5-year cure, far from bad. In a series of 26 cases, we have had the good fortune to have 7 cases, i.e., 26.9 per cent, remain free from recurrence for more than 5 years.

It seems to us that hysterectomy for cancer of the body of the uterus should be combined with radiological postoperative treatment. Of the 22 cases of cancer of the body which have been sent to Radiumhemmet for postoperative radiological treatment after total hysterectomy or supravaginal amputation, more than 17 are alive after 5 to 14 years, corresponding to a permanent cure of 77.3 per cent. This figure is so much more favorable than the average result for operation alone (58.8 per cent, see Table III) that it seems definitely to favor postoperative irradiation.

CANCER OF THE VAGINA

The surgical treatment of this condition, even in those rare cases in which a radical operation is feasible, rarely yields permanent results.

At Radiumhemmet, radiological treatment has been tried during the period from 1914 to 1923 in 14 cases, most of them in an advanced stage. Of these 1 is alive 11 years and another 6 years after the treatment. A third patient died, after having been well for 11 years, from ileus, confirmed by autopsy.

We must regard this result, 21.4 per cent of cures, as remarkably good. In our opinion operation should be entirely replaced by irradiation in cases of this type.

CANCER OF THE OVARIES

In the gynecological literature the 5-year cure by operation alone in radically operable cases of cancer of the ovaries is generally estimated to be about 30 per cent, somewhat higher for unilateral and considerably lower for bilateral tumors. Judging from our results, a permanent cure is more often obtained in radical operations when combined with postoperative irradiation. At Radiumhemmet we have had, in a series of 32 cases, 65.6 per cent of 5-year cures. In 27 unilateral tumors the percentage was 76. Of 5 patients with bilateral tumors, 2 are alive after more than 5 years.

In cases in which it has been impossible to perform a radical operation because of metastases, but in which it was possible to remove the ovarian tumors, remarkable results have often been obtained by radiological treatment. In a series of 30 such cases treated at Radiumhemmet, there are quite a number of patients who for several years have been kept free from symptoms and able to work. Among those are

7 who were under observation for 5 years or more. The cases differ too much clinically, the patho-anatomical classification is too incomplete, and the material of the different groups is too small to allow of a statistical estimation of the results.

In completely inoperable cases the radiological treatment is, it is true, of an exacting nature, but can, if correctly carried out, bring with it a considerable reduction of the tumor and a marked temporary improvement in the general health of the patient. In some cases the patient can be kept free from discomfort for 1 or 2 years. Only twice have we seen 5-year cures; in neither of those was the diagnosis microscopically verified. One of the patients lived for 9 years and died of recurrences, the other one is alive and has been free from subjective symptoms for the last 7 years.

With the view to improve, if possible, the outlook for a permanent cure, I have in recent years performed a re-laparotomy in those cases in which the tumors have shrunk and become mobile under radiological treatment. In 3 out of 5 such cases, the operation was easily performed. Of those 1 is alive and has been free from recurrence for the last 2 years and another for the last 9 months.

Thus, in our opinion, no permanent results can be obtained in the treatment of cancer of the ovaries without resort to surgical intervention. On the other hand, it is undoubtedly true that an intimate co-ordination of radiological and surgical treatment can improve the results considerably. The removal of the ovarian tumors should always be tried, if the risk involved is not too great. If the risk is too great, then it is better to trust to radiological treatment. In the surgical treatment we would advise the operator not to remove the uterus, but to retain it so that it may be used as a means of applying the radium in after-treatment, thus enabling the radium-container to be centrally placed in relation to the original site of pathological change. After operation radiological treatment should be instituted without delay.

SUMMARY

Briefly summarized, our opinion regarding the interrelationship between surgical and radiological treatment in cancer of the female pelvic organs is as follows:

In cases of cancer of the cervix, radiological treatment is the method of choice. Operation should be resorted to only if radiological treatment has failed.

Operable cases of carcinoma of the body should be operated upon and submitted to postoperative irradiation.

Regarding the relatively large group of border-line cases in which surgical interference, on account of general conditions and technical difficulties, is less advisable, one must, in making the choice between surgical and radiological treatment, carefully consider the size and shape of the uterine cavity. Surgical treatment is to be preferred in cases with a large and irregular uterine cavity, whereas radiological treatment is more likely to be successful if the cavity is narrow and of regular shape.

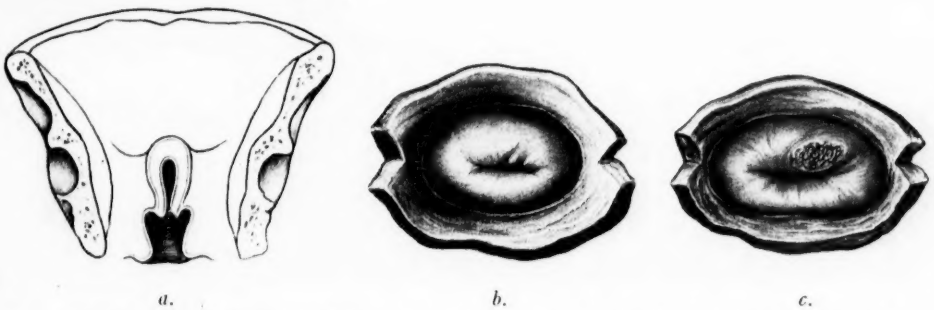
In cases of cancer of the vagina, surgery ought to be entirely replaced by radiology.

In cancer of the ovaries an intimate co-operation between surgical and radiological treatment is required. Surgical treatment, aiming at the removal of the ovarian tumors, must be tried first. In patients who have had the radical operation as well as in those who have not had the radical operation, operation must be followed by irradiation. In a number of these cases radiological treatment will bring about a considerable improvement and in some it may pave the way for a subsequent successful operation.

In order to be able to substitute entirely or in part radiological for surgical treatment to the extent advocated in this paper, it is necessary to have at one's disposal a radiotherapeutic institution which, first of all, should be equipped with all technical appliances and instruments for thorough comprehensive roentgen therapy and radium therapy. Second, there should be in addition a well organized department of social service for following up the patients, and finally, the clinic must be under the direction of well trained and experienced radiologists with an adequate staff.

DISCUSSION

DR. HENRY SCHMITZ, Chicago: Perusal of the statistics given by our distinguished visitor, Professor Heyman, and others contained in medical liter-



a. *b.* *c.*

Fig. 1. The findings on palpation and inspection of a Group 1 localized carcinoma of the vaginal portion of the uterine cervix. a, Section showing the absolute localization of the carcinoma within the limits of the cervix uteri. b, The beginning cancer nodule. c, The ulceration of a cancer nodule. d, Sagittal section showing the invasive tendency of the clearly localized cancer nodule and ulcer.

ature may well explain the continued interest of the medical profession in the controversy as to whether surgery or radiotherapy is the treatment of choice in carcinoma of the uterine cervix. Whoever has had the opportunity to visit the Radiumhemmet at Stockholm, to study its organization and purposes, and to see the 5-year good end-results obtained in the treatment of carcinoma in the various regions of the body will admit that this success is due to the unbiased attitude of the Swedish medical profession and to the technique of radiation treatment and the follow-up system developed under the leadership of Forssell, the director, since 1910.

In the United States the question whether to operate upon or to treat with radiation carcinomata of the cervix uteri is still under discussion. Cases which should come within the scope of surgery and those which fall within the scope of radiotherapy can be definitely selected. It is obvious that those patients should be operated upon in whom the growth can be totally eradicated, and that those patients should be subjected to radiation treatment in whom the entire cancer cell bearing area can be exposed to a lethal radiation dose. Relative operability or relative radiability should not enter the surgeon's judgment. To facilitate the selection of cases for these therapeutic measures, a grouping has been formulated in our clinic which is based on the clinical findings of the extent of the tumor by palpation and inspection as follows:

1. Beginning nodule or ulcer not larger than 1 centimeter in diameter with normal mobility of uterus and adnexa.

2. A tumor or ulcer involving one-half or all of the cervix in either the transverse or the longitudinal diameter, and a dough-like consistency of the paracervical tissue. The uterus then assumes a decreased mobility due to loss of normal elasticity of the adjacent connective tissue.

d.

3. (a) Tumor or crater of the cervix with rigidity of adjacent tissues; (b) involvement of the parametria, the regional lymph nodes, or both. The mass as a whole has impeded mobility.

4. (a) Involvement of the parametria, the regional lymph nodes, or both, with fixation; (b) involvement of bladder, rectum, or vagina; and (c) distant metastases (Figs. 1 to 12).

The indications for the various methods of treatment are as follows: in the clearly localized carcinomata of Group 1, either panhysterectomy or radium may be employed; in the doubtfully localized carcinomata of Group 2, radium is used; the clearly inoperable or advanced carcinomata of Group 3 indicate a combination of radium and X-ray treatment; and the terminal or fixed carcinomata of Group 4 require palliative treatment. A fixed carcinoma in any part of the body as a rule gives an absolutely bad prognosis and should not be subjected to needless and expensive treatment.

Operability depends upon the following factors: (1) normal mobility; (2) patency of the cervical canal; (3) afebrility of patient; (4) absence of pathogenic

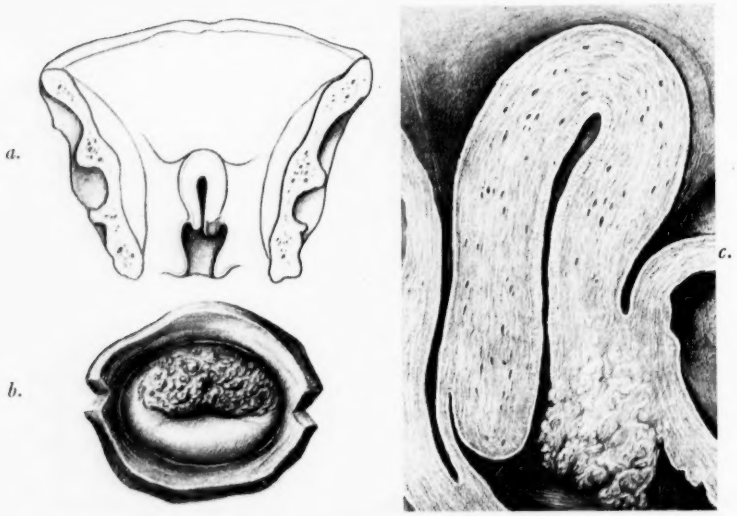


Fig. 2. The findings on palpation and inspection of a Group 2 doubtfully localized carcinoma. a, Invasion of at least one-half of the cervix uteri. b, The visual findings. c, Sagittal section showing the invasion of the paracervical connective tissue.

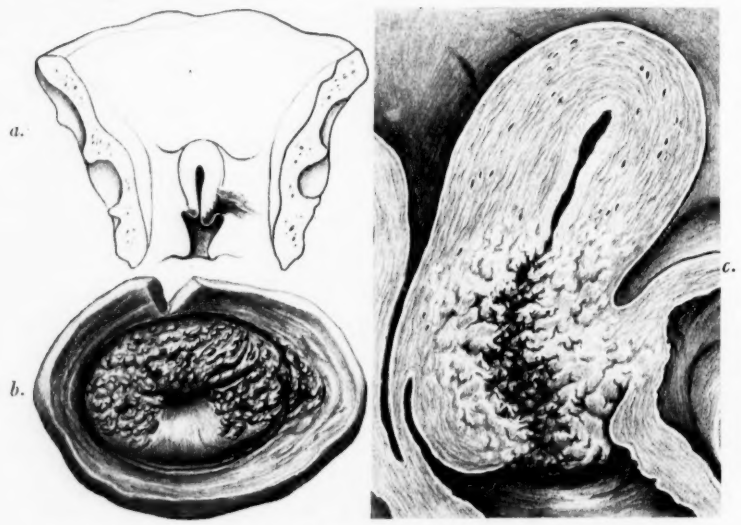


Fig. 3. The findings on palpation and inspection of a Group 3 advanced carcinoma. a, Transverse section showing extension into parametrium and progressive invasion of entire cervix. b, The visual findings. c, The extension toward adjacent organs seen in a sagittal section.

bacteria in the genital canal; and (5) good surgical risk. The absence of any one of these 5 conditions contra-indicates surgery. Mobility is normal if the uterus can be pulled down without res stance to the introitus vaginæ with a tenaculum forceps applied to the cervix. Patency of the cervical canal is tested by the insertion of a uterine sound. Stenosis is always an evidence of pyometra. Afebrility should be

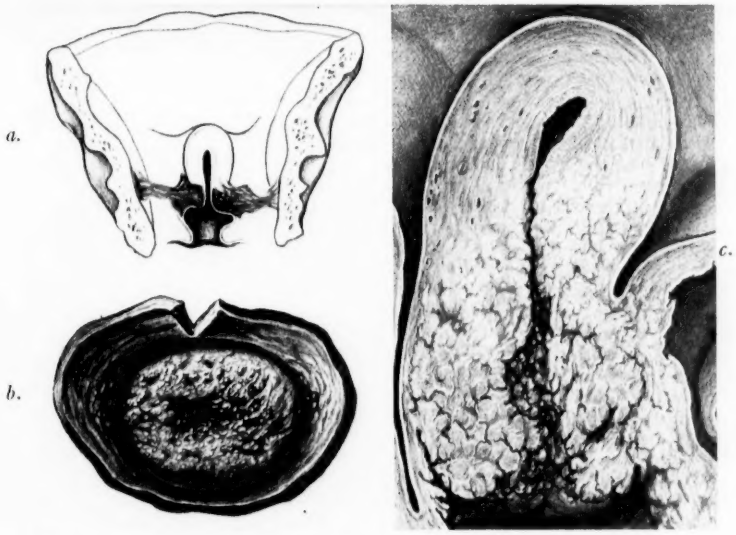


Fig. 4. The Group 4 terminal carcinoma with fixation. a, Transverse schematic section showing the frozen pelvis. b, The visual findings. c, The extensive involvement of uterus seen in a sagittal section.

determined to rule out such infectious processes as parametritis, adnexitis, perimetritis, and non-pelvic infections. Differential leucocyte counts will aid in the finding of active infectious processes. The pathogenicity of the cervical canal flora may be decided by the Ruge and Phillips test. Ten centimeters of defibrinated blood taken from the patient's arm vein and placed in a Petri dish are inoculated with the cervical discharge. If cultures grow within 4 hours one may assume that pathogenic bacteria are present. The surgical risk depends upon many factors, such as: grave metabolic disturbances; renal, cardiac, hepatic, and pulmonary diseases; and severe degrees of anæmia. Some of the conditions may be overcome by proper medical management and operation may then be performed.

The contra-indications to the use of radiation are:

1. General emaciation and cachexia. When these are present, radiations may cause a rapid increase of both and early death.

2. Anæmia with a red cell count below 3,000,000 and a hæmoglobin index below 50 per cent. Radiations have a tendency to produce an oligo-erythrocythæmia and leucopænia and hence may increase the anæmia to a danger point.

3. Impaired nitrogen metabolism. Radiations as a rule produce a rapid increase in the blood nitrogen which may assume dangerous proportions in the presence of an impaired nitrogen metabolism.

4. Complications in the urinary and rectal tract. Bullous œdema and carcinomatous involvement of the bladder or the rectal mucous membrane, fistulæ, and urinary retention due to obstruction or cancer invasion of ureter and kidney, either with or without infection, are made worse by radiation irritation and fibrosis.

5. The frozen fixed pelvis is usually an indication of an existing generalized carcinomatosis.

6. The presence of inflammatory lesions or foul sloughing condition of growth or pyometra. Experience has shown that local manipulations may aggravate such infectious conditions.

7. Amenorrhœa and pregnancy. Radiations are detrimental to the normal development of the fetus. Some of these conditions may be overcome by proper medical treatment, when radiations may be used.

The rules given have been carefully observed in our clinic. Variations in the subjective interpretation of operability and inoperability have thereby been reduced to a negligible number. Since 1917 operations for carcinoma of the cervix uteri have been discarded, and all cases, except those in Group 4, have been treated with radium and X-rays. The low percentage of absolute operability, the high frequency of contra-indications to surgical treatment, and the good end-results of radiation treatment were the reasons for this decision. Should a carcinoma of the

TABLE I.—THE FIVE YEAR GOOD END-RESULTS OF RADIATION TREATMENT

Clinical Group	1	2	3	4	Total
Total number.....	23	48	161	100	332
Number of 5 year good end-results..	18	20	20	0	58
Percentage of 5 year good end-results..	78.27	41.68	12.42	0	17.51

cervix uteri of Group 1 or 2 prove refractory to radiation therapy, then operation may be considered to offer the patient a possible chance of relief.

The 5-year good end-results prove that radiation treatment of carcinomata of the uterine cervix gives a high percentage of absolute cures without the high morbidity and primary mortality of surgery.

They also indicate that the control of cancer of the uterine cervix depends on an early admission of the patients, an immediate diagnosis, and prompt and adequate treatment. The smaller the growths are the higher should be the percentage of 5-year good end-results.

The clinical grouping of carcinomata based on the demonstrable extent of the tumor enables one to choose the indicated treatment and to compare the absolute curability percentage obtainable with either surgery or radiation treatment. It also aids in the prognosis, as cancers of Group 4 characterized by fixation almost always offer a poor prognosis, while the chance of recovery in Group 3 carcinomata is about 1 in 8, in Group 2 carcinomata about 4 in 10, and in Group 1 carcinomata about 8 in 10.

Dr. Arthur H. Curtis, Chicago: Doctor Heyman's contribution is a refutation of the old adage to the effect that statistics are unreliable. Nation-wide earnest co-operation of the most eminent men in all Scandinavia, laboring with one object in view, working not merely with the sanction of the government but assisted by it in every possible way, has resulted in this most valuable paper. Permit me, sir, to express to you our deepest admiration and respect for your work.

Lack of time necessitates a limitation of my remarks to a brief consideration of the treatment of carcinoma of the cervix.

Early years of disappointment in my attempts to cure cancer by operation, and a vivid impression that the surgical results of others were not so good as statistics indicated, impelled me to turn to the exclusive use of radium in nearly all cases of cancer of the cervix immediately upon introduction of radium therapy into this country. My late associate, Dr. Watkins, continued to operate upon favorable cases until approximately 8 years ago, at which time we made a survey of our combined experience. This demonstrated that radium treatment has been definitely superior to operation.

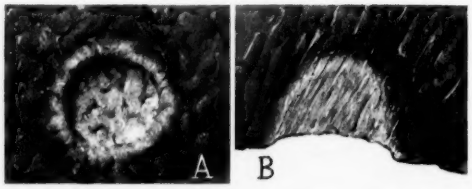


Fig. 2. Surgical diathermy. A, Surface view of raw beef cooked by diathermy electrode; B, sectional view revealing depth to which tissue is cooked. The depth of destruction of the tissue may be varied at will according to the strength of current and time of application.

With the passage of time I have been increasingly impressed with the value of radium and with added experience in the technique of radium therapy I have noted a continuously greater percentage of clinical cures.

The technique of radium treatment is of vital importance. Simple introduction of radium capsules into the uterine canal fails to protect adequately against advancement of the cancer in the most critical regions, the adjacent cellular tissues. For approximately 10 years I have thrust radium needles deeply into the tissues in a palisade encircling the

Fig. 1. Carcinoma of cervix; radium therapy. A, Cervical view, showing radium needles thrust into the tissues in a palisade encircling the cervix; B, sectional view. The needles should be slanted slightly toward the uterus.

Fig. 3. Schematic illustration of surgical diathermy treatment of carcinoma of cervix. *E*, Electrode; *A*, depth to which tissue is visibly cooked; *B*, extent of tissue destruction; *C*, radius of heat destruction of cancer cells; accumulated evidence indicates that this may equal or exceed the usual range of radium activity.

diseased cervix, at the same time inserting a chain tandem of radium capsules into the uterine canal (Fig. 1). The needles which are plunged into the bases of the broad ligaments should be slanted slightly toward the uterus; otherwise there is a possibility of ureteral injury.

Lesser surgical procedures may be employed with advantage in a considerable percentage of patients at the time of radium application. Upward displacement of the bladder permits enormous increase in the dosage of radium to the anterior cervix and anterior vaginal wall in patients whose tumors tend to extend in this direction. The same is true of the posterior vaginal wall in those cases in which the progress of the growth is toward the rectum. In years past our tendency has been to radiate lightly those extensions in the vicinity of the bladder and of the rectum. Now we find that these viscera, when not invaded, may be protected by simple dissection and retraction away from the region which we desire to radiate.

Surgical diathermy. The surgical world seems to have forgotten the excellent results obtained by Byrne with the galvanocautery; overzealous employment of the Percy method of cauterization has apparently resulted in unjustifiable antipathy to heat destruction.

Since 1922 I have employed surgical diathermy as an adjunct to radium in the treatment of cervical carcinoma (Fig. 2). This form of heat destruction possesses all of the advantages of the actual cautery and is free from many of its disadvantages. No open wound is created; the destroyed tissues separate by cleavage in about 10 days, leaving a smooth surface beneath. Destruction extends to approximately twice the depth to which the tissues appear cooked upon incision (Fig. 3). Accumulated evidence indicates that the cancer cells are destroyed far beyond this, often definitely beyond the usual range of radium activity.

Diathermy is most useful in the treatment of cauliflower cancer and necrotic cancer which has extensively destroyed the endocervix. Heat penetration of this character sometimes achieves remarkable results; in conjunction with radium—sometimes without radium—it has added very materially to the percentage of our clinical cures.

SUMMARY

I wish to stress the importance of radium treatment beyond the outermost demonstrable extension of the growth.

I would emphasize the helpfulness of mobilization of the bladder and of the rectum in selected cases, in order that we may radiate malignancy of the cervix with the utmost efficiency, without danger of visceral injury.

Finally, I am impelled to urge that we all make use of surgical diathermy; it is a most valuable adjunct to radium in the treatment of cancer of the cervix.

SURGICAL TREATMENT OF ACUTE INTESTINAL OBSTRUCTION[1]

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EVERY recovery from acute mechanical intestinal obstruction is due to modern surgery. Without surgery, all would die. Surgeons save from 40 to 70 of each 100 cases of obstruction. We should save at least 90. This ideal is attainable. Its realization does not demand a larger conception of the mysteries of the death-producing factors or newer methods of treatment. An intelligent application of our present knowledge of the pathology, symptomatology, and operative management is all that is necessary to save 90 per cent of obstructed cases. No disparagement is intended to the many faithful, painstaking workers in the experimental field, who are endeavoring to solve the problems of the causes of obstructive deaths. When their work is finally completed, we possibly may be able to realize 98 or 99 per cent recoveries. Up to the present time, the experimental laboratory has produced little that has been useful clinically in lowering obstructive mortality. The administration of chlorides, as brought out by Haden, Orr, and others, is of definite value.

We have nothing new or startling to present. We shall simply call attention to well known facts, and emphasize some that we believe are important in improving surgical results in mechanical obstruction of the bowel. There is no field in abdominal surgery that challenges our attention more than this.

Refinements in surgery of the appendix, the kidney, the gall bladder, the stomach, and the pelvic organs may save 4 or 5 per cent more lives than now; whereas in acute obstruction, an improvement of 20 to 50 per cent in our results is possible.

The incidence of intestinal obstruction will increase. Hundreds of thousands of laparotomies are being done every year. Each is potentially a case for ileus. Of our 177 operations for obstruction, 76 (43 per cent) were caused by previous abdominal operations done from a few days to 25 years before.

All clinicians agree that the operation must be done early. The results depend more on *when* than by whom and how. An early operation by a novice in surgery is safer than a late operation by a master. Unlike cancer, the very hour of onset in obstruction is announced. Its progress is proclaimed by severe, colic-like pains repeated every few minutes. Woe unto the patient and discredit to the physician when these proclamations of pain are silenced by the hypodermic of morphine. Morphine is responsible for fully one-half the operative deaths. It delays operation many hours and obscures otherwise obvious signs. It never does good, but always harm. Abdominal pain, when sufficiently severe to require the hypodermic of morphine, generally demands that the sufferer be hospitalized at once and that means be taken to determine the cause of the pain. We have had two patients that were given repeated hypodermics of morphine for gall-stone colic, but operation revealed in each a late case of obstruction. Both died, not from the laparotomy, but from the hypodermic. These should be classified as hypodermic deaths and not operative deaths.

The official death certificate in the state of Oregon has these questions: "Did an operation precede death? For relief of that condition? Date of." To place the responsibility properly, the certificate should ask in addition: "Was morphine administered to this patient? If so, how much, when, and by whom?"

The vast majority of physicians, as well as surgeons, recognizes the dangers of morphine. Every surgeon frequently encounters its deadliness. By repeated warnings, surgeons can educate the general practitioner to withhold morphine in abdominal pain. Such efforts produce results.

In one year recently, we had only 3 deaths in 24 referred cases of obstruction. This is less than one-half the average mortality in our referred cases. The responsibility of late operations is occasionally on the patient, rarely on the surgeon, but generally on the physician first called. Of our 34 deaths, 20 can be attributed to the delay caused by morphine

[1]Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

Fig. 1. Intestines covered with hot gauze napkins.

Fig. 2. Test tube with rubber tube about 2 feet long.

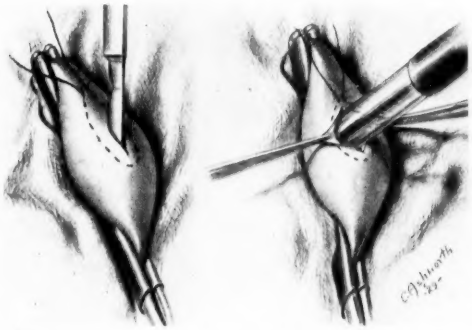

Fig. 3. Opening bowel and inserting flanged end of test tube.

administered by the first physician. In only 3 did the patient seek medical aid late. In 2, I was responsible for the fatal delay. Of the 9 remaining, 7 were cases of cancer of the large bowel. The sudden, severe pain urges the patient to send at once for a physician. The sufferer seems intuitively to realize that relief cannot be expected from spinal manipulations or meaningless incantations.

A fairly accurate provisional diagnosis can be made at the bedside. No special apparatus or complicated maneuvers are necessary. A clinical thermometer and an enema can are the only indispensables. The five cardinal symptoms and signs are: (1) *pain*, (2) *vomiting*, (3) *blocked bowel*, (4) *visible peristalsis*, and (5) *no fever*.

1. The pain is abdominal, sudden, severe, cramp-like, and colic-like. Sleep is disturbed or impossible. The patient knows the very hour when "gas pains," as he frequently calls them, began. The pain is not referred to the bladder or under the right scapula. It is always present. Morphine erases this symptom from the picture.

2. Vomiting is generally seen. At first, it is reflex; later it is constant from overflow of the stomach. Fæcal vomiting indicates that the case has been mismanaged and further treatment will be unavailing. Obviously, the higher the obstruction, the earlier constant vomiting will appear. In low obstruction of the large bowel, vomiting may not be present. Morphine destroys the significance of this symptom.

3. Blocked bowel is frequently overlooked because the bowel will move once or twice after the obstruction has occurred. The bowel empties below the obstruction. After this, there is absolute constipation. Neither gas or fæcal contents are passed. Repeated enemas should be given. Cathartics must never be administered; they do no good, but only harm. Not infrequently do we see patients who believe that they have bowel obstruction, because the bowels do not move and enemas are unproductive. This is not a mechanical block, for they have no pain or vomiting.

4. Visible peristalsis is frequently, though not always, seen. Its importance is underestimated. We regard it as very valuable. In conjunction with the other four cardinal symptoms, it makes the diagnosis certain. Peristalsis cannot be seen if the patient has morphine. The fat abdominal wall obscures this sign. If the abdominal muscles are rigid, as occasionally happens, it is quite useless to look for visible peristalsis. Contrary to the statements of some, it is an early sign. We have seen it 5 or 6 hours after beginning of the ileus. It is a sign that is most valuable in determining the presence of obstruction in drainage appendix

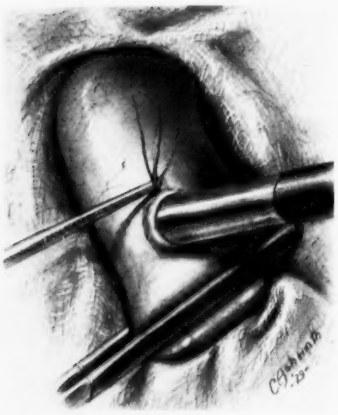

Fig. 4. Hæmostat on pursestring suture. Intestinal clamp on distal side of enterostomy.

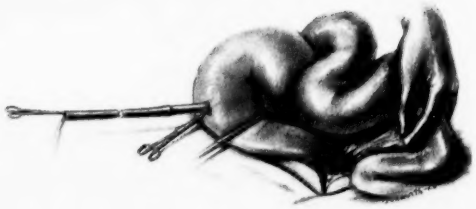

Fig. 5. Note that the tube is held nearly horizontal.

cases, which develop mechanical block while still in the hospital. We have had 12 such cases—10 of our own and 2 referred. One patient (a referred case) died. Eleven recovered. All showed visible peristalsis, and it was the determining factor in deciding the diagnosis in each instance. Let us consider a drainage appendix case in which the first few stormy postoperative days have passed. The bowels have been moving, and the temperature, pulse, respiration, and general condition are satisfactory. Suddenly, the patient complains of colic, accompanied by vomiting, but no fever. After the first bowel movement, enemas return clear. Within a few hours, if sought for, visible peristalsis can be demonstrated. Even in the presence of a drainage wound, this sign promotes absolute confidence in the necessity of re-opening the abdomen.

In looking for visible peristalsis, the entire abdomen should be exposed. The patient must be in a good light. We frequently spend an hour or more inspecting the abdomen from directly above, lengthwise, and crosswise. We may repeat this inspection after a few hours. A hasty glance at the abdomen is insufficient. An ampule of pituitrin hypodermically will at times magnify peristaltic waves until they can be seen plainly. Visible peristalsis does not always indicate obstruction. Babies may show this sign from a number of conditions. Hirschsprung's disease shows marked peristaltic waves. Elderly women with thin, flabby abdominal walls, show peristalsis, but they have no pain, vomiting, or a blocked bowel. Visible peristalsis is pathognomonic of mechanical obstruction only when accompanied by the other four cardinal signs.

5. Early, uncomplicated obstruction has no fever. Many physicians believe that there is increase of temperature in obstruction. The absence of fever in one referred case led the attending physician to decide erroneously against obstruction. Another time, by calling attention to a temperature of 103 degrees, we persuaded the attending surgeon to postpone operation for ileus. The eruption of small-pox 3 days later made the postponement permanent.

The following may be regarded as occasional or minor signs: (a) relaxed abdominal wall; (b) tumor; (c) bloody mucus from anus; (d) distended abdomen; and (e) leucocytosis.

Relaxed abdominal muscles are very often seen. The muscles are flaccid. Placing the hand on the abdomen gives one the sensation of palpating a rubber water bag filled with water and no air. This flaccid condition of the abdominal muscles renders possible the phenomenon of visible peristalsis. If there is a considerable mass of strangulated bowel, the abdomen will be rigid. In intussusception and cancer of the large bowel, a tumor may be felt. Bloody mucus from the bowel is present in intussusception and at times in cancer.

Textbooks stress distention of the abdomen. Marked distention is a late sign, and we should not wait for it. Early, the abdomen will be neither scaphoid or distended to any degree. We must make our diagnosis before distention.

The leucocyte count is not important. It will vary from mild to high. It is of little value in making a diagnosis.

Fig. 6. Assistant is pulling the intestine through the fingers of the operator.

The X-ray is extolled by some. Its use should not cause any delay. Only flat plates are permissible. Barium may be troublesome if there is obstruction. We have made very little use of the X-ray. The provisional diagnosis by the general practitioner often is made where there is no X-ray. It seems preferable to emphasize the simple, common, clinical signs and symptoms rather than suggest means of investigation that often are unavailable. We must simplify rather than complicate the early diagnosis of obstruction. The X-ray is not essential to an early diagnosis. There is no objection to X-ray if its use does not delay operation.

No effort is made to determine the site or cause of the obstruction. "*Is* there an obstruction?" Not "*where*" or "*why?*" is the question to be promptly answered. The location and cause of obstruction may be harmless speculations. Determination of the presence of obstruction, somewhere, from some cause is the great essential. On opening the abdomen, we can very quickly discover the situation and nature of the obstruction.

Operation must be performed early, i.e., from 12 to 24 hours after the onset of the attack. General anæsthesia (nitrous oxide and ether) is the routine. In strangulated external hernias, local anæsthesia is most often used. The incision should be ample. We use the long mid-line from pubis to a few inches above the navel (Fig. 1, a). A short incision prolongs the operation and is incompatible with accurate work.

Excepting in strangulated external hernias, we employ evisceration in most cases. As soon as the intestines are removed, they are covered with large, warm, salt, gauze napkins (Fig. 1). These are kept the proper temperature by the addition of more warm compresses. The temperature of the operating room should be at least 80 degrees F. If the chilling of the viscera and traction on the mesentery are

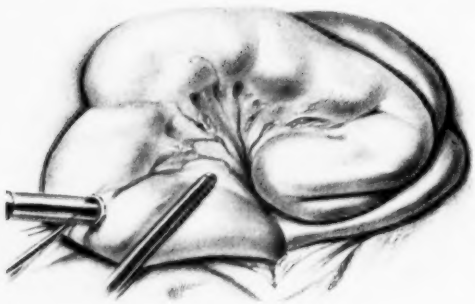

Fig. 7. Intestine empty and flattened after stripping.

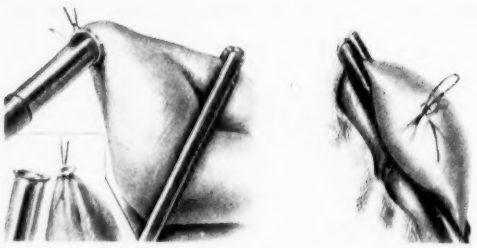

Fig. 8. Preparing to remove the test tube. Note that the flanged end is held high. Completing the closure of the enterostomy wound.

avoided, shock seldom will be seen. By evisceration, the exact pathology is quickly located and promptly corrected.

We have on several occasions resected the sigmoid when it was the seat of a volvulus and its circulation was questionable. Non-strangulated, obstructed, adherent coils may be short-circuited by an entero-enterostomy. We have done this only once, but regret that it was not used in 2 other cases.

Resection of gangrenous bowel is always hazardous and it is generally preferable to leave both proximal and distal ends of the bowel protruding through the abdominal wall. Anastomosis can be done later. Obstructing cancer of the large bowel also demands a two-stage operation. Intussusceptions are best reduced by the pushing back of, rather than by traction on, the invaginated bowel.

When the obstruction is relieved, the work is only partly done. There is a difference of opinion among experimental workers in regard to the toxicity of the imprisoned contents of the bowel above the obstruction. We believe that these contents are toxic. For 12 years, we have emptied the bowel above the obstruction.

An ordinary glass test tube ¾ inch in diameter, with a good flange at its upper end, is selected. The closed end is cut off and fitted with a piece of rubber tubing not over 2 feet long (Fig. 2). Near the obstructed point, preferably just below it, a *strong* pursestring Lembert linen suture is placed longitudinally in the bowel. This small loop of bowel is caught lightly in an intestinal clamp. The intestine is opened within the pursestring linen suture (Fig. 3). The flanged end of the test tube is inserted into the lumen of the bowel, and the pursestring is drawn taut with only the first loop of the knot and clamped with a hæmostat close to the tube. The intestinal clamp is removed and placed just distal to the test tube (Fig. 4). The distal end of the rubber tube is held at one side of the patient by a nurse (Fig. 5). The operator's hands are now generously anointed with sterile vaseline. Beginning as near the duodenum as possible, the intestines are rapidly but gently pulledthrough the vaselined fingers by an assistant (Fig. 6). This strips the contents of the bowel through the test tube and rubber tube into a basin held by the nurse (Fig. 7). This maneuver may be repeated. Several pints of foul bowel contents may be secured. The intestinal clamp is then returned to the small loop of bowel holding the test tube (Fig. 8). The hæmostat is released, the pursestring loosened enough to allow the flanged end of the test tube to slip out of the bowel and the pursestring immediately tightened. This closes the opening in the bowel without soiling the peritoneum. A Lembert suture completes the closure of the intestinal wound. As the test tube is withdrawn, its flanged end is held higher than the rubber tubing.

This entire procedure requires only 5 or 6 minutes. This loss of time is fully compensated for by the ease with which the abdominal wound may be closed and the time saved in that procedure. We recommend the test tube because of its simplicity and availability. The glass tube allows us to see whether the apparatus is working. Dr. Sweek, of Phoenix,

has devised a metal tube with a sliding shoulder and set screw to take the place of the test tube. It is a good instrument. The rubber tube should be short and held nearly horizontal by the nurse, otherwise siphonage will draw the wall of the bowel into the tube. Three times we have been troubled by having the tube clogged with masses of corn or berry seeds. If the rubber tube is cut shorter these masses may be removed by a long gall-stone scoop.

For more than 12 years we have used this procedure in practically all of our cases of obstruction, except external hernias. A few times in exceptionally early, simple cases, we have omitted it, but each time the stormy convalescence caused us regrets. Before we employed this means, our obstruction cases ran a very stormy course in which vomiting was annoying and gastric lavage was necessary every few hours for 2 or 3 days. Patients with obstruction, once they are relieved of the imprisoned bowel contents, run a smooth convalescence. Lavage is rarely necessary and postoperative vomiting is no more frequent than after an appendectomy.

The operation should be done with as little loss of time as is consistent with careful work. To allow from 30 to 40 minutes is ample. The abdomen is closed without drainage.

Proctoclysis, with normal saline, is routine. Hypertonic salt solution, subcutaneously, has been employed the past few years. For the first 24 hours sufficient morphine is given to make the patient comfortable. Cathartics are rarely administered and never before the fourth or fifth day.

Our impressions are based on the cases shown in Table I.

Of our 34 fatal cases 2 died after leaving the hospital. One had gangrene of the lung following postoperative pneumonia. He was an old man, with strangulated hernia, which required resection. Autopsy showed a perfect abdominal condition, but gangrene of the lung.

Another man died of lung abscess several weeks after leaving the hospital. This patient had some infection in the abdominal wound—a right rectus incision. It is presumed that he had a septic embolus from the deep epigastric vein. Inasmuch as both of these patients died of complications, directly associated with their surgical relief for obstruction, we include them in our deaths, even though they died after leaving the hospital.

TABLE I.—RESULTS

	Cases	Died	Mortality per cent
Cancer (large bowel)	22	7	32
Hernia (strangulated)	39	6	16
Postoperative adhesions (old)	64	14	22
Postoperative adhesions (new, occurring before leaving hospital)	13	1	8
Intussusception	15	2	13
Volvulus	13	2	16
Miscellaneous	11	2	18
	177	34	19⅓
Referred cases	119	31	26
Not referred cases	58	3	5⅙

Of our 177 cases 58 were first seen by myself or associates, with 3 deaths (5⅙ per cent). No pre-operative morphine was given in any case. One of these was 48 hours old when we first saw the patient. The other had a 24-hour delay for which I was responsible. There were 31 deaths (26 per cent) in the 119 referred cases.

Both classes of cases had the same operator and the same operation. One had five times the death rate of the other. Why? Delay! Why the delay? Generally—*morphine!*

CONCLUSIONS

Our conclusions may be summed up as follows:

1. Surgical mortality of occult intestinal obstruction should, and *can*, be 10 per cent or less.

2. Early operation, i.e., within 12 or 24 hours is essential.

3. The medical profession must avoid the pre-operative use of morphine and cathartics for acute abdominal pain.

4. The imprisoned bowel contents above the obstruction should be removed.

5. Hypertonic salt administered subcutaneously and normal salt solution given by rectum are necessary to replenish the lost chlorides.

DISCUSSION

DR. JOHN A. WOLFER, Chicago: I wish to congratulate the essayist for his courage in standing firmly on the ground of common sense in the diagnosis of acute intestinal obstruction. There is no question but that by far the largest percentage of

cases can be correctly diagnosed early if the physician apply himself and use those everyday methods available everywhere and at all times. The careless use of morphine cannot be too severly condemned. In spite of the facts that all students of medicine have been cautioned against it and that the disastrous results of folly in this matter are frequently seen by the practitioner, this pernicious habit still thrives. It is only by continuous, stern criticism of the offender that we may hope to curb this undiscriminating practice.

I heartily agree with the speaker as to the use of the X-ray, especially with opaque contrast media. It seems to me that the possibility of acute intestinal obstruction should be a strict contra-indication to the oral use of barium. Barium enemata can be used in suspect colonic obstruction but their value must not be overrated. I have seen one case in which a roentgenological diagnosis of sigmoid obstruction was made because the opaque material would not pass beyond a certain area in the sigmoid. Operation revealed a normal bowel but an enormous gall bladder filled with large stones and extending well below the umbilicus.

In studying a case of intestinal obstruction, I believe that stress should be laid upon the effort to differentiate between simple mechanical block and strangulation. When a simple block exists the symptoms are as a rule not so urgent and more time is available for a study of the case, while in strangulation the symptoms are often characterized by early collapse with toxæmia. Surgical interference, if it is to be successful in the latter case, must be instituted very early—at the end of 24 hours it is too late. When it is deprived of blood supply, it requires but a few hours for the wall of the gut to become pervious to bacteria, peritoneal soiling takes place, and a highly toxic condition obtains, which if allowed to exist for over 12 hours invariably leads to death in spite of surgical interference. In this type of case, there is often an early fusion of mechanical and paralytic ileus.

In case of pure mechanical block, haste may be subservient to careful study and preparation of the patient and possible conservative treatment. As an example, let us consider a patient with symptoms of simple mechanical block coming on after an operation for perforative appendicitis, with the wound discharging considerable pus. Good surgical judgment would possibly frown upon entering the peritoneal cavity in such a case unless absolutely necessary. I have seen several cases of this type, all very closely observed, which were relieved spontaneously and to date have remained well. I have operated upon 1 patient 8 days after the onset of mechanical block, following a suppurative appendicitis, and the patient, who had been receiving proper pre-operative care, came to the operating table in excellent condition and withstood the operation very well. I do not wish to advocate waiting 8 days but simply to illustrate that haste which might involve a mistaken diagnosis or unnecessary operation is not warranted in this type of disease.

Dr. Holden did not specifically call attention to one phase of the surgical treatment which I am sure he uses and which is often a life-saving measure—the pre-operative preparation. In the neglected cases of simple mechanical block and in case of strangulation, a high-grade toxæmia exists, there is marked dehydration, often with star vation, and the blood chlorides are frequently low. These patients are poorer surgical risks than they appear to be. This I have learned from a few bitter experiences. The repeated introduction of physiological salt solution or Ringer's solution will materially assist the patient to withstand the contemplated operation. When starvation is present, glucose solutions given intravenously are of material benefit. Perhaps a blood chloride estimation may be worth waiting for and, if the blood chlorides are very low, the introduction of hypertonic salt solution before the operation may be a wise procedure.

As far as the operative procedure is concerned, the type of case to a considerable degree dictates the nature of the procedure. I try to enter the abdomen in the vicinity of the obstruction if this can be determined pre-operatively. If I may be pardoned, I cannot agree with the speaker in performing routine evisceration and gut drainage. I do not use or advocate evisceration except in case of necessity. My own experience has taught me that, if the abdomen can be opened, the bowel held aside, the obstruction found and relieved, and closure done without further manipulation, the patient will have a smoother convalescence than when evisceration is done and an effort made to empty the bowel. I cannot get away from the impression that the insult to the gut coincident with evisceration and drainage is more than the good such a procedure can possibly accomplish. Moreover, I have never been able to remove what to me seemed a quantity of intestinal contents sufficient to be of any distinct benefit to the patient. This impression is arrived at in spite of the fact that laboratory workers tell us the absorption of toxic material depends upon the pressure within the imprisoned bowel. So long as the bowel wall which is proximal to the obstruction has the power of contracting, it will empty its contents into the distal gut. I doubt if removing some of the fluid content when the gut is paralyzed will benefit the patient to a degree commensurate with the shock of the procedure. In those cases in which evisceration is necessary, either because of the enormous distention, or because of the surgeon's inability otherwise to find the obstruction, an attempt to empty the bowel may be warranted because it does at times help in the replacement of the intestines.

Highly toxic patients with high intestinal block are extremely ill and will tolerate little surgical interference. In such cases immediate operation brings on a fatal issue. If we hope to save such patients, it is only through the careful pre-operative preparation—the intravenous introduction of copious

quantities of Ringer's solution, hypertonic salt solution, and glucose. Insulin may be used in well-controlled cases. The stomach should be kept empty by continuous aspiration. It is surprising to see the improvement such a regimen often brings about in the condition of the patient.

When operation is carried out in case of low obstruction with marked distention, approaching a paralytic ileus, it is often a question whether a hurried enterostomy is not a wiser procedure than an attempt to relieve the obstruction, if the latter is a time-consuming method. Moreover, an enterostomy may be a valuable adjunct even after the obstruction has been relieved. In case of strangulation, if the bowel is found not viable, the question again arises as to whether a resection should be done. I believe that if there is a considerable question in the mind of the operator, he should decide in favor of bringing the strangulated loop out of the abdominal cavity and intubating the proximal orifice, leaving the repair for a subsequent operation. Under these conditions the ability to evaluate the patient's tolerance to withstand a contemplated operation requires close study and keen surgical judgment.

I wish to thank Dr. Holden for bringing this most important surgical condition to our attention. Surely he is correct in this statement than "no field in abdominal surgery challenges our attention more than this."

Dr. Lester R. Dragstedt, Chicago: This paper by Dr. Holden is so definite, clear, and correct in all of its essentials, and emphasis has been placed so properly upon the necessity of early diagnosis and immediate surgical treatment, that I am sure the author will bear with me if I attempt a few explanations from experience in the laboratory. I am disappointed that he has found so little help from the work of the experimental surgeons, and yet some of the questions he raises have been already answered.

It is becoming daily more clear that we must sharply differentiate between obstruction in the upper intestine and obstruction lower down. In the former case, the obstructing agent is most commonly scar tissue contraction or occlusion from intra-intestinal or extra-intestinal tumor, or bands, in which there is little or no injury to the bowel circulation either directly or through increased intra-intestinal pressure. In such cases, the cause of morbidity and death is the failure of re-absorption of the water and salts secreted in the gastric and pancreatic juice.

I have put the question of the importance of the re-absorption of gastric juice to crucial test in some experiments reported at the recent Physiological Congress in Boston. The stomach was short-circuited in such a way that its secretion was not inhibited, but the gastric juice passed directly to the exterior instead of into the intestine. There was no obstruction in the alimentary tract of these animals and yet they died very promptly with the same changes in the blood chemistry as develop in a case of simple high obstruction. The loss of gastric juice through failure of re-absorption in the lower intestine could be regularly compensated for by the intravenous administration of Ringer's solution or 0.9 per cent sodium chloride. In every case of high obstruction and in many low obstructions, the first obligation of the physician is to restore to the body the lost water and salts and then to correct the condition which prevents the re-absorption of digestive juices in the lower intestine.

In lower obstructions, however, in which there is a considerable length of absorbing intestine between the stomach and the obstruction site, this factor of failure of re-absorption of the digestive juices plays a less important rôle. In these cases, injury to the vascular supply to the intestine, through distention or strangulation, is more apt to occur, and this condition permits the absorption of the toxic substances which have accumulated in the obstructed bowel. It is to be emphasized that these substances are not appreciably absorbed by the normal mucosa and no concern need be felt if they are discharged into the collapsed distal intestine after relief of the obstruction. My experiments have convinced me that the factor which permits their absorption from the obstructed proximal loop is the development of increased intra-intestinal pressure which secondarily interferes with the circulation of the mucosa. Treatment is accordingly directed toward the relief of this pressure and herein lies the only virtue of enterostomy and, of course, of the removal of such intestine as is irrevocably damaged.

Dr. Frederic A. Besley, Waukegan, Illinois: Dr. Holden's masterly presentation of the subject of surgery of intestinal obstruction offers for discussion one of the most important problems with which the surgeon has to deal. This problem usually presents itself as an emergency and taxes all the ingenuity and surgical experience of the surgeon, for upon his judgment as to proper procedure may depend the life of the patient. The condition is somewhat unique in that it presents the twofold pathological situation involving both the biochemical physiological disturbance within the canal and in the intestinal wall and the mechanical anatomical obstruction to the fæcal stream. There has been much discussion of this involved and intricate subject, and a wide variance of opinion exists as to the advisability of invariable drainage of the content of the bowel by enterostomy, with or without dealing with the mechanical obstruction at the time, or of attack upon and correction of the direct cause of the blocking, leaving the intestine intact. Obviously, each case is a law unto itself, with the multitude of signs, symptoms, and differences in the pathological condition. The judgment of the surgeon as to the better method is influenced by all of this. An experienced surgeon was once asked what procedure he followed in these cases. He replied that sometimes he did just an enterostomy, but occasionally he did not and instead confined himself to the relief of the mechanical obstruction, with or without opening the

bowel. He declared that no matter which operation he had done he frequently had regrets later and wished he had proceeded differently. Dr. Holden's criticism and condemnation of the use of morphine is timely and well stated. It is a striking commentary on the slowness of education that such a warning is necessary, for the danger of masking symptoms by giving morphine in acute abdominal pathology has been taught for years. He very properly emphasizes the essential importance of the time element, for delay leads to dehydration and exhaustion of the patient.

The differences of opinion and controversy relative to the exact site of the formation of the more virulent toxins, whether in the jejunum or in the blocked and distended canal proximal to the point of obstruction, still exist. It would appear rational and logical to assume that toxic changes do occur in the distended gut, and this deduction is borne out by the experimental work of several investigators. If this be true, a simple jejunostomy does not provide the best method of drainage. The stripping and the emptying of all of the content of the bowel from the duodenum to the obstructed segment would seem to approach the ideal procedure.

One comment on this manipulation is justified. The stripping of the intestines between the fingers should be done with the greatest gentleness to avoid the compression of the wall and the forcing into the lymphatic and blood streams of the toxins that have formed and accumulated within the layers of the bowel itself. Experience teaches that in many cases it is unnecessary to do a complete evisceration of the bowel in locating the site of the obstruction, for the finding and following up of the thin ribbon of collapsed bowel, distal to the blocking, frequently leads one easily and quickly to the offending pathology.

Dr. Holden deserves great credit for his thoughtful consideration of this subject. He has worked out each detail with meticulous care and the excellent results that his statistics present are most convincing and justify his deductions and his conclusions.

ORATION ON FRACTURES[1]

CHARLES L. SCUDDER, M.D., F.A.C.S., BOSTON

THE institution by the American College of Surgeons of an oration on fractures is significant; it shows a growing appreciation of the importance of this department of surgery. I value greatly the honor which has been placed upon me in asking me to deliver this first address.

At present no other subject in surgery is of more vital concern to the public and the medical profession than fractures.

Many problems which arise in the treatment of fractures are yet unsolved. Let me enumerate a few:

1. The securing of accurate records of clinical observations, which can serve as the basis for dependable conclusions.

2. The understanding of the relation of fractures to industry.

3. The necessity for sound ethical practices.

4. The further development of new methods of treatment.

5. The proper treatment of the rapidly increasing number of bizarre and complex types of fractures, the results of railroad, motor vehicle, and airplane accidents. During 1928, about $41,000,000 was spent by the railways of the country for the treatment of personal injuries, and of that amount $20,000,000 was paid for the treatment of fractures.[2]

6. The advancement of direct and indirect research into the processes of repair, involving physical, chemical, physiological, and pathological studies, which opens up fascinating and promising fields.

These problems are the most momentous faced by the surgeon today.

"The art of surgery is far in advance of all the sciences upon which its future depends. Until they stand abreast, the progress of surgery will be slow. Some day science will outdo the art and take its legitimate place as the basis of sound treatment. By swift changes in progress, surgery has become safe and still more safe, until it can be asserted that a further increase of safety for the patient can depend only upon an earlier access of the surgeon to him.

"The chief risk in surgery today comes from delay. Surgery has been made safe for the patient; we must study to make the patient safe for surgery" (Moynihan).

Chronic duodenal and gastric ulcers were permitted to advance to perforation, peritonitis, and fatal hæmorrhage until comparatively recent times. Fractures are now wittingly allowed to go beyond the time at which successful treatment may be instituted. Such delay in the initial treatment of a fracture forever precludes the possibility of preventing disabling deformity. In some of these cases even death itself might be preferred to the permanent disability, with which we all are familiar.

In our attitude toward fractures, we must eradicate from thought certain deeply rooted conceptions of disease.

There is no incubation period in a fracture. In the ordinary case of fracture, there are not 6 days in which to wait for an organism to react. The accident is instantaneous. The fracture is present. The reparative processes begin immediately. Therefore, treatment should begin without delay so that the reparative processes may be facilitated instead of hindered.

By treating a fracture instantly you treat the fracture. By treating a fracture after delay you treat a fracture plus complications.

Early treatment is easy. Delayed treatment is difficult. Delayed treatment is dangerous. Late treatment is lamentable.

At this time, may I sketch briefly for you the treatment of fractures? I should like to stress one phase of treatment and to say a word concerning the relative usefulness of the two great methods of treatment.

The successful treatment of fractures is predicated upon the correctness of one's conception of the four ends to be achieved. These

[2] Findings of the Bureau of Railroad Economics, based upon the report of the Interstate Commerce Commission.

[1] Delivered before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

four goals, if you please, may be called the four R's of treatment, viz.: (1) the restoration of the individual; (2) the reposition of the fragments; (3) the retention of replaced bones; and (4) the return of the injured man to society.

When I remember that I am speaking to an audience of trained surgeons, I do not expect that I shall say anything that is new to you. The baldest statement of what is meant by the restoration of a case of fracture is sufficient.

By restoration, I understand the surgeon's mental picture of the entire progress of the case, from its inception to a complete cure. In approaching a case of fracture, the surgeon will, as a matter of course, assemble all available data—everything relevant to the case—as he does in preparation for any other surgical procedure. A perfect host of conditions may impose themselves about a fracture and postulate treatment. To decide upon the initial treatment is often most difficult. When the surgeon has taken account of every adventitious circumstance and correlated all data, he will note the exact lesion as revealed by the X-ray. He will choose a treatment as closely adapted as may be to all the existing conditions. He will look into the future; he will visualize the initiation and the progress of the treatment chosen.

This imagined restoration of the patient includes far more than the prognosis. It includes the progress of the patient from the time of the injury through completed treatment.

The restoration of the patient is the vision of the reasons underlying the surgeon's choice of a particular method of treatment. This conception of the restoration is the backlog of all treatment; it is the foundation of successful fracture therapy.

The habit of the active utilization of well understood principles is the final possession of wisdom. The really wise surgeon establishes treatment in consonance with his idea of the restoration of the case.

Unless the restoration concept is sound, treatment cannot be sound. The treatment selected will be not only correct but the best possible if based on a clear vision of the restoration of the case. Concerning reposition, I shall have something to say in a moment.

The retention of reposed fragments must be accomplished in the treatment of all fractures, and is so effected as to permit eventually the greatest possible active movement in involved or adjacent joints.

The return of the patient to society means the progress from job to job, that is, from job lost to job secured. The return includes: (a) the rehabilitation of the injured part; (b) the restoration of joints, muscles, tendons, nerves, and circulation; and (c) the recovery of function by the damaged part to the greatest degree possible, as early as possible.

All fractures are treated by non-operative or operative methods, or by combinations of these two. The procedures available in the non-operative treatment are: (1) traction and counter traction; (2) manipulation; (3) pressure and counter pressure; (4) leverage; and (5) rotation.

Traction and counter traction may be applied by: (a) gravity; (b) manual means; (c) skin hold; and (d) block and pulley, with hitch about the ankle or wrist, intermittently; with or without electrically driven motor; and (e) skeletal attachment.

It is my firm conviction that a chief cause for poor results in the treatment of fractures lies in the failure to recognize certain mechanical forces, and in the inappropriate, imperfect, and inadequate application of the available forces of traction and manipulation. Each of the ways mentioned for securing traction in the use of the non-operative method may be attended by dangerous consequences. To employ correctly non-operative methods of reposition requires training, a natural mechanical sense, skill, devoted interest, and a good conscience.

May I exhibit now a series of cases of fracture treated by non-operative methods? (At this point were shown 40 slides of cases of fracture treated by non-operative methods. Each case exhibited shortening and deformity. The slides presented the condition immediately after the accident and again following the treatment.)

These patients were each and all seen early; there was no delay, and each received treatment by non-operative methods, well conceived and well applied. The four R's of treatment were ideally carried out. The results are good. The patients were treated in different clinics[1] throughout the country and undoubtedly could be duplicated in the experience of many here. These cases illustrate splendid achievement. Such results are possible by the use of the non-operative method and a large proportion of all fractures may be so treated with success.

The general practitioner or general surgeon first treats most fractures. He may properly and safely continue to do this, provided he is familiar with simple adequate emergency treatment and is also aware of his own limitations.

The great difference between the non-operative and operative treatment of fractures lies in the procedure of repositioning the fragments.

The restoration, the retention, the return to function, all are common to the two methods. The repositioning of fragments is indirect by one method, and is direct by the other method.

Twenty years ago, at the time of the popularization and exploitation of the operative treatment of fractures, I said in Atlantic City, in opening the discussion of Sir Arbuthnut Lane's paper: "We are not ready for the popularization of the operative fracture treatment in this country. We should advance fracture treatment by developing non-operative methods." Gentlemen, time has proved that that opinion expressed in 1909 was correct.

Today, I believe the situation in this country is changed and is as follows: The operative treatment of fractures has become a firmly established practice. It is based upon necessity, asepsis, and a clearer knowledge of the pathology of repair. It is a safe and sound treatment. It is no longer a method of last resort. It is often the method of primary choice. The results of such operative treatment when safeguarded and carried out by competent men are brilliant.

Today the non-operative treatment of fractures, properly applied by skilled and trained practitioners, gives superb results, as witness the cases briefly shown you tonight.

When one considers the extent to which the present acknowledged fundamentals of both the non-operative and operative treatment of fractures are neglected by some members of the surgical profession, it is difficult to restrain a savage rage.

My theses tonight are:

1. That surgeons must demand the early treatment of fractures.

2. That the non-operative methods of reposition used are entirely inadequate.

3. That when proper non-operative methods are used, good results are obtained.

The two great methods of treatment available, the non-operative and the operative, are developing and being perfected to such an extent that a satisfactory choice of treatment can be made only by the interested and skilled surgeon.

[1]The Beekman Street Clinic, the clinic of James Worcester and Robert Kennedy, New York; of Earle Conwell, Fairfield, Alabama; of Arche Hall, Detroit; of John Moorhead, New York; of George Hawley, Bridgeport, Connecticut; of Willys Campbell, Memphis, Tennessee; and of the Massachusetts General Hospital, Boston.

THE INCIDENCE OF CANCER AMONG THE INDIANS IN THE SOUTHWEST[1]

BURTON J. LEE, M.D., F.A.C.S., NEW YORK

MEDICAL opinion is unanimous that cancer is seldom, if ever, found in full bloods of the Indian race. Many physicians who have spent several decades in the reservations of the Southwest believe that cancer never occurs in a full blood Indian. Hrdlicka in 1906, and Levin in 1910 came to the conclusion that malignant tumors were rare in the American aborigine.

The opportunity was afforded me during the past summer to visit a number of the Indian groups in northern New Mexico and Arizona, and it appeared opportune to seek information upon cancer incidence and, if found to be low, to find an explanation for it.

I wish to make it clear that this brief paper is not based upon any physical examinations made by me, but it seemed that a survey of the subject, with the data at hand, might provide a fruitful topic for our consideration.

I was able to interview quite a number of physicians and trained nurses in the field, as well as intelligent wives of traders and school teachers, who had spent years among the Indians. Through the friendship of my courier with the Pueblo inhabitants, I was able to enter many homes and talk with the Indians themselves. Whenever I heard of an individual suffering from cancer and I asked the question whether the patient was a full blood or mixed blood Indian, the answer was almost invariably "mixed blood." At Keams Canyon, Arizona, Dr. D. G. Lynwalter told me that he had seen 4 cases of unquestionable cancer in Indians but that none of the diagnoses had been confirmed histologically. The first 3 cases occurred in mixed bloods, but the fourth patient was an Indian woman suffering from cancer of the breast and he was reasonably certain that she was a full blood Indian. The patient disappeared when operation was suggested.

Dr. Martin, of Taos, who is completing more than 35 years of medical service with the Indians of that locality, said that he had never seen a case of cancer in a full blood Indian. Hoffman, in 1928, in an excellent contribution, came to the conclusion that cancer did occur in full blood Indians, but that the incidence was extremely low, and Miss Jenss, quoted by Hoffman, was of the same opinion. She corresponded with a large number of doctors in the field and it is surprising how few cases of cancer were reported. The population of the Navajo Reservation is 30,000. One of the best hospitals in this area is the one at Fort Defiance, Arizona. From 1910 to 1927, this institution admitted but 27 cases of malignant tumor, of which 22 were carcinoma, although this hospital is fairly accessible to perhaps two-thirds of the Indians on the reservation. One interesting case in this series was that of a full blood Navajo woman, with carcinoma of the breast, who was operated upon by Dr. Polk Richards. A confirmatory histological diagnosis was made by Dr. Robert Greenough, of Boston, so that there is little doubt that carefully checked observations and diagnoses would demonstrate cases of cancer in full bloods.

Great difficulty exists in determining the cancer incidence of such a primitive people. The Indian is reticent and suspicious of the white man. His long series of unfortunate experiences, as civilization has pushed him aside, have added to his unwillingness to cooperate. The religious practices and prejudices of the Indian, bound up closely with the activities of the medicine men, have held him aloof from medical care by the white race.

Until recently, the type of medical service furnished the Indian population of the Southwest has been of poor quality. The few hospitals of the area are widely separated. Those that do exist, with one or two exceptions, are poorly equipped. Records and case histories are in many instances incomplete or lacking altogether. Although the medical personnel contains some excellent men, the hospitals are inadequately staffed with doctors as well as

[1]Presented before the Clinical Congress of the American College of Surgeons, October 14–18, 1929.

nurses. The X-ray equipment is often obsolete. Laboratory facilities for tissue examination and study are seldom available. The inhabitants of the territory not immediately adjacent to the hospitals receive little medical care.

In justice to the medical staffs of hospitals serving the Navajos, one must bear in mind their nomadic character, which makes consecutive observations often impracticable. Indian names are recorded with difficulty, and the patient may give either his Indian or his Americanized name. Among the Pueblo Indians there are few well organized hospitals. The one at Taos, under the direction of Dr. Martin, is an exception.

Hoffman has pointed out that a relatively large number of Indians die from unknown causes, the figure being 18 per cent for the Indian registration area in 1925, this area not including Oklahoma, New Mexico, or Arizona. Indian prejudice and religion prevent the obtaining of autopsy material, resulting in the loss of much valuable information.

No accurate census of the Indian population has been made since 1910. Statistical data collected under such conditions must be of little value, and the exact proportion of full and mixed bloods is unknown.

Any effort, therefore, to determine the incidence of cancer in the Indians of northern New Mexico and Arizona is attended with difficulty, and conclusions reached may be inaccurate or incorrect. If one grants that the evidence, such as it is, points to a low cancer incidence, an explanation should be sought in sociological and clinical, rather than in purely racial, factors.

There is little doubt that the Indian race is shorter lived than the white. One sees many Indians with all the outward signs of advanced age, and there is no question that some are long lived, but the proportion is smaller than in the white race.

Infant mortality is very high. I visited many Indian homes in which 3 or 4 children had been born and only one survived, the deaths having occurred in infancy. Few Indian families have more than 2 or 3 children and many but 1. The hygiene, feeding, and general care of Indian infants appear to be so poorly managed that one marvels that more do not succumb.

Tuberculosis causes the greatest number of deaths among the Indians of this region. In the total registration area, in 1921 to 1926, 22 per cent of the reported deaths of Indians resulted from tuberculosis, as compared with only 7 per cent of the deaths among the white population attributed to that disease. The prevalence of tuberculosis was apparent everywhere. Many special hospitals admit only tuberculous patients, and I frequently encountered the disease in some general hospitals.

Considering the very high infant mortality and the alarming loss of life from tuberculosis, pre-eminently a disease of youth, one could not help feeling certain that fewer Indians than whites reach the cancer age.

If we consider cancer as it occurs in various regions of the body, what factors may be responsible for a lower or apparently lower incidence in the Indian?

Epithelioma of the skin is an exceedingly rare disease. This form of cancer is readily accessible for examination and ought to be apparent, if it exists, in the Indian. One might reasonably expect to find cutaneous cancer in this race, because of the prolonged exposure of the Indian to the sun's rays, but it is possible that the amount of pigment in the skin serves as a protection. One Indian trader with whom I talked had seen an old man with an extensive lesion of the side of the face, adjacent to the nose, who later succumbed to the disease. His description of the growth would pass very well for a basal-cell epithelioma, but such evidence is inconclusive.

Epithelioma of the lip is seldom encountered. The Fort Defiance Hospital admitted between 1910 and 1927 but 1 case of cancer of the lip, and that in a woman. The Indian has smoked for generations. I found them always glad to accept cigarettes and they smoked them with avidity, but their supply of tobacco is apparently limited and they do not indulge in the continuous smoking which is the habit of many of our own race. Persistent repeated trauma to one segment of the lip from excessive smoking is apparently infrequent in the Indian.

Five factors contribute to the production of intra-oral cancer in the white race, namely: (1) jagged, irregular teeth; (2) carious teeth and infected mouths; (3) gold filled or gold crowned teeth; (4) persistent tobacco smoking; and (5) lues. The two first are found in the Indian. He has better teeth than the white man, as he is called upon to masticate coarser foods and partakes less often of sweets, but nevertheless, jagged, irregular, and carious teeth, and infected mouths are not unusual. Little dental work has been done for the Indians, and few of them have filled or capped teeth. Persistent smoking is less often encountered than in the white race, and all agree that lues is a rare disease among the Indians, except at points of contact with civilization. It would appear probable that 3 of the 5 factors contributing to intra-oral cancer are seldom present in the Indian.

The apparent infrequency of cancer of the breast may be explained upon two grounds:

1. The Indian women nurse their babies over much longer periods than is the habit of civilized races, in which infants often are weaned shortly after birth. This practice brings about an interruption of physiological lactation and there is considerable evidence to suggest that such an interference with the normal mammary function may favor the development of carcinoma.

2. Indian women manifest such unwillingness to subject themselves to examination by doctors of the white race that many cases of the malady may be undiscovered.

Cancer of the uterus is seldom recognized. Children are born without the aid of physicians, for the practice of obstetrics is carried on by native women; or the mother may be unattended when she bears the child. Under these circumstances, cervical lacerations must occur. It is certain that Indian women are no more cleanly in their habits than those of the white race and the non-specific vaginal flora should be identical. Gonorrhœa is infrequent in the Indian, but a causal relationship between this infection and the development of carcinoma is questionable. The unwillingness of the Indian woman to submit to pelvic examination would appear to be an important element in attempting to determine the facts, as it prevents disclosure of the disease. Moreover, it seems reasonable to believe that many Indian women dying from "unknown causes" may have succumbed to uterine cancer.

Cancer of the stomach is rarely discovered. The habits of the aborigine may contribute to a lower incidence of gastric carcinoma. The food is coarse in texture and requires more complete mastication, which results in a better admixture with the salivary juices. The flour which the Indians use is less refined than our own. Their meat is sun-cured, is firmer, and must be chewed more completely than the cooked meat of civilized man. Salt is sparingly used. Indulgence in iced drinks is slight, and alcoholic beverages are not often taken, for the Indian is not as persistent a drinker of alcohol as the white man. The Indian does not use excessively hot food or drinks, and he is a comparatively light eater. All of these factors may combine to account for a lower incidence of gastric cancer. Nevertheless, the large number of Indians dying from "unknown causes" may well include a considerable percentage of undiscovered cases of cancer of the stomach.

Cancer of the rectum ought to be less frequent in the Indian race. The large amount of physical exercise taken by the Indian is in marked contrast to the usual sedentary mode of living of civilized man, and elimination must therefore be more complete and automatic. They are without access to the modern toilet which induces straining at stool, hæmorrhoids, and constipation. The habit of squatting in the act of defæcation is a more normal physiological position, resulting in less rectal irritation. For these reasons one might expect cancer of the rectum to be less frequent than in the white race.

CONCLUSIONS

The following conclusions may be drawn from this brief study:

1. There appears little doubt that, in certain regions of the body, namely, the skin, lip, and intra-oral cavity, cancer incidence is lower among the Indians than in the white race.

2. The same statement may be true of the incidence of cancer of the rectum.

3. On theoretical grounds, one would judge cancer of the stomach to be less frequent in the Indian than in the white man.

4. If the interference with normal lactation, as practiced in the white race, is proved to have a causal relationship to the development of cancer of the breast, this disease should be found less often in the Indian race than among white peoples; otherwise, one would expect it with equal frequency.

5. If it could be demonstrated that gonorrhœa—a disease rare among the Indians—is an important factor in the production of cancer of the uterus, the incidence of the latter disease in the Indian race should be less than in the white race. If such a premise is incorrect, then the frequency of cancer of the uterus should be equal in the two races.

SUGGESTIONS FOR FURTHER STUDY

It is obvious that dependable clinical and laboratory data on such a subject are sadly lacking. Complete reorganization of the medical care of the Indian would appear necessary if the true facts on cancer incidence in this race are to be discovered. Moreover, no plan to obtain the information desired can be put into operation unless it includes an effort to improve the mutual understanding between the two races.

The following suggestions along constructive lines are therefore offered for your consideration:

1. A system of medical registration should be instituted in which both Americanized and Indian names, and the presence of full or mixed blood should be recorded.

2. The present general hospitals should be increased in number and provided with modern surgical and X-ray equipment.

3. A centrally located laboratory for routine examinations and research should be organized, available to the hospitals of the entire area.

4. The present hospitals for tuberculosis and trachoma should be reorganized and enlarged, thereby making it possible to rid the general hospitals of such cases.

5. The medical and nursing staffs of the existing hospitals should be increased, and, whenever possible, younger practitioners with leanings toward scientific research should be added.

6. Health centers might well be established on the Navajo Reservation and among the Pueblos.

7. Adequate social service in conjunction with hospitals and health centers is, above all else, urgently needed to make effective the medical care of the Indian.

I believe that the execution of such a program would result in a vast amount of much needed service to the Indian and the acquisition of much valuable information upon the subject of cancer incidence.

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THE RECOGNITION OF EARLY CERVICAL CANCER[1]

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ALL the statistical studies presented at this meeting and all those which have been made for many years past point, as inevitably as does the compass to the magnetic pole, to one crucial conclusion, viz., that the duration of the cancer, far more than any other single factor, determines the fate of the patient. This is true, regardless of whether radium or surgery is the therapeutic agency employed, so that on this one point all those engaged in the fight against cancer can meet on common ground.

My own contribution to this symposium will be limited to a brief discussion of the means available for the recognition of the very early cases, the group in which we have every right to expect a large proportion of cures. The percentage of permanent cures in this group is far greater than the percentage we are now obtaining in cases as they actually come to us. This, therefore, is the strategic line of advance which must suggest itself to all of us.

Two plans of action are open to us. We need not make a choice, for both must be utilized. One of these, of course, is the education of women as to the significance of abnormal bleeding and discharge, more particularly beyond the age of thirty.

This movement, begun within very recent years, is gaining great momentum under the stimulating sponsorship of the American College of Surgeons, the American Medical Association, and the American Society for the Control of Cancer. Fundamental as is this educational campaign, I shall not discuss its methods or results, for I prefer on this occasion to address myself to a discussion of the need of a corresponding effort to rouse our own professional ranks, so that cancers in the earliest stages will be dealt with in the same alert fashion as the late cases.

The educational campaign will do only one thing. It will bring an increasing number of women with suspicious symptoms to the doctors of the country for diagnosis and advice. It would be a sad commentary on our profession, if these women, alert and confiding enough to seek advice, were met by apathy or lack of thoroughness and conscientiousness on our part. This criticism has already been made with regard to another great medical movement, that advocating the periodic health examination of presumably healthy individuals. We must not give cause for similar criticism as to our cooperation with those seeking to protect themselves against cancer. I need not tell this audience how morbid the dread of cancer is in the minds of many individuals, but no such patient should fail to receive a sympathetic hearing and, if necessary, examination from his medical adviser. Such a consultation should always include a simple exposition of the subject to the individual patient, reassuring her when reassurance is called for, and advising her sanely as to how she may protect herself in the future. When all our consultations become educational and preventive in this sense, a great step forward will have been taken.

No physician today is ignorant of the possibly ominous significance of abnormal bleeding in women approaching or at the middle period of life. Furthermore, no physician except the unteachable few inevitable in every walk of life, will fail to make at least a simple pelvic examination in such cases, or see that someone else does. Nor is there any great risk that cancer will be overlooked, if such an examination discloses a large cauliflower growth of the cervix or a foul excavated cancer ulcer. But how much benefit accrues to the patient even if such a lesion is discovered? Her chances for life are relatively small. And yet the concept of cancer held by many of our profession is just the type of lesion I have pictured; much as the old clinical picture of appendicitis was really that of the complicating peritonitis that follows per-

[1]Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

foration and too often is, in turn, followed by death.

This, then, is the motif of my paper, i.e., that the profession should put aside the picture of what is really the late cancer lesion, and familiarize itself with the picture of the early cancer. In its early stages a carcinoma of the cervix is not a conspicuous lesion. It appears usually as a small hardened area in one or other lip of the cervix. The surface is granular, bleeds on slight touch, and may, even in early stages, be covered with fine sprout-like outgrowths. In other cases, as where a cancer develops in an old erosion or ectropion of the cervix, the cancer area may be more diffuse. The more experienced the examiner and the more advanced the lesion, the easier it is to detect the earmarks of malignancy.

But this, after all, is not the point I am striving to stress, for we cannot expect every family physician in the country to assume the responsibility of saying whether or not a given lesion is an early cancer. We can, however, hope that medical men generally will appreciate what characteristics make a lesion suspicious enough to want the question definitely settled. For that matter, even the expert gynecologist cannot, from the mere clinical appearance of the lesion, be sure, in a certain proportion of cases, whether he is dealing with an early cancer or with an inflammatory lesion. But he can settle the point, in almost every instance, by making a biopsy and a proper pathological examination. This means putting the patient and himself to a little trouble, but the reward is great. It may mean the recognition of a very early cancer, with excellent prospects of cure. More often, perhaps, it means the diagnostic elimination of cancer, with ensuing peace of mind for the patient and with the consciousness, on the surgeon's part, of a diagnostic problem well handled.

How much better this is than the policy of taking a chance that the lesion is not cancer, and consigning the patient to a probably fatal delay if cancer really exists. And how much better than for the surgeon to solace himself, after unnecessarily radical treatment, by saying, "Oh, well, if it wasn't cancer, it was at least 'precancerous.'" While "precancerous" lesions should be corrected, their eradication does not call for radical surgery or radium. In the vast majority of cases, very simple corrective procedures, such as radial cauterization of the cervix, trachelorrhaphy, or tracheloplasty, will suffice. But before these simple procedures are resorted to, the surgeon should be sure in his mind that cancer is not present.

It is hardly necessary to emphasize that the vast majority of cervical lesions is obviously benign or obviously malignant, so that it is only a small proportion, probably well under 5 per cent, which calls for biopsy and decisive microscopic diagnosis. But this group of very early cases, and the early cases in which, even without the microscope, the diagnosis is reasonably certain to the trained observer, together should make up a considerable fraction of our cases. Our aim should be to increase the proportion of these relatively favorable cases, on the one hand by popular education, on the other by developing our skill in the recognition of the early stages.

In the diagnosis of the very early stages the microscope must make the diagnosis, rather than merely confirm it, as in the later stages. The tissue to be submitted for microscopic examination must be obtained by biopsy, the excision being not of course at random from the suspected cervix, but from the area, often quite small, which is directly under suspicion. Furthermore, the sections must be cut in such a way as to show the epithelial surface; otherwise the examination may be not merely worthless but actually dangerously misleading.

There has been much discussion as to the possible danger of biopsy—whether or not it may permit of rapid dissemination of cancer cells. As regards the field of cervical cancer, there is no evidence as yet to substantiate this fear. Furthermore, even if there were some risk, we would resort to biopsy anyway in the group of cases in which the diagnosis cannot be made in any other possible way. The information to be gained is of such vital importance to the patient that it far more than counterbalances any supposed

or real danger of biopsy. Nevertheless, in view of this possible element of risk, it behooves us to take such precautions as appear indicated to circumvent it, such as the cauterization of the edges of the biopsy wound, the complete excision rather than incision of suspicious areas when possible, and so on.

The value of biopsy is nullified unless the pathological examination is made by one skilled in the interpretation of the rather specialized pathological pictures encountered in the cervix. Mistakes in the diagnosis between malignant and non-malignant disease are more readily made here than in almost any other tissue, because of the very great frequency of inflammatory lesions which resemble cancer in many ways, and which are nevertheless perfectly benign. These peculiar pictures are due chiefly to the tendency of the squamous epithelium to invade the deeper tissues. I shall show some of these pseudomalignant pictures on the screen, but shall not discuss them at any length, as I have considered this whole subject in a paper which appeared in the October, 1929, issue of the *American Journal of Obstetrics and Gynecology*. It should be emphasized, however, that such misleading pictures are exceedingly common, especially with chronic endocervicitis and cervical polypi, and that they have often been mistaken for cancer, but that the trained pathologist can, with rare exceptions, make the differentiation correctly. In the paper above alluded to, I have collected figures indicating the trustworthiness of biopsy and proper microscopic examination of cervical tissue in differentiating cancerous from non-cancerous lesions, as determined by the subsequent histories of patients who have been subjected to this procedure.

In this field of work, the gynecological pathologist, so called, has a genuine advantage over the general pathologist, who does not have equal opportunities for familiarizing himself with this rather specialized type of lesion, even though somewhat analogous pictures are at times encountered in other organs. This is of course no reflection upon the ability of the small army of tissue pathologists who are rendering such excellent service in hundreds of hospitals, large and small, throughout the country. Nor should it be interpreted as a "holier-than-thou" attitude on the part of gynecological pathologists, who, in their turn, would be woefully at sea if called upon to make differential diagnoses in lesions of the bones, nervous system, and other specialized fields.

The practical question which must suggest itself to the surgeons in this audience who are doing such conscientious work in communities perhaps far removed from specialized workers in this field will naturally be as to how, in view of what I have said, they can be sure of the correctness of those diagnoses which depend upon microscopic examination of suspicious tissues. Fortunately the aggregate number of such doubtful cases is relatively small, and in these the conscientious surgeon and pathologist can always enlist, to share their responsibility, others who presumably have larger opportunities for studying such lesions. Consultations in the difficult cases of pathological practice serve a purpose no less useful than consultations in clinical practice.

I have said nothing as to the clinical symptoms which should lead the physician at least to suspect the possibility of cancer, for these are familiar to you all. Nor have I discussed the question of prognosis on the basis of the histological characters of the constituent cancer cells as determined by the microscope. This question has been studied by Broders, Martzloff, and others, but it cannot be considered as finally settled. Some of the systems of histological classification suggested are suitable and rational, others are intricate and unimpressive. The histological malignancy index, as given by one writer, is based upon nearly twice as many "points" as the famous fourteen with which President Wilson prodded the Germans.

SUMMARY

To summarize the facts I have tried to stress, and to include a few others which limitations of space will not permit me to discuss at length, I shall set forth, in rather aphoristic fashion, the following statements:

1. The diagnosis, even the early diagnosis, of late cervical cancer is easy, but it confers little benefit on the patient, for her chances for cure are poor. It can usually be made by the simplest kind of pelvic examination.

2. The diagnosis of early cervical cancer is often difficult, but it means much to the patient, as it gives her a relatively good chance for life. It requires experience, a careful pelvic examination, including the use of the speculum in a good light, and, in a certain proportion of cases, biopsy and microscopic examination.

3. Biopsy is *not* necessary if the cervix is of normal appearance; or if an area of erosion or eversion is pink, smooth, firm, and non-vascular, without areas of either induration or friability.

4. Biopsy *is* indicated if there is an indurated area on either cervical lip, especially if the overlying surface is granular, vegetative, or ulcerated, and very vascular. It is also indicated if, in an erosion or ectropion, there is a hardened or raised area, with vascularity, sponginess, or tendency to ulceration of the surface.

5. Biopsy may be performed with a sharp knife or punch, followed by searing of the wound edges with the cautery.

6. The tissue should be excised from the most suspicious area, and the sections should be cut in such a manner as to show the mucous surface. It is desirable to cut a number of sections at different levels in the block.

7. The pathological examination should be made by a competent pathologist, preferably by one thoroughly familiar with the special pictures encountered in this field. In most cases the diagnosis is easy, in some cases difficult, and in a very small *residuum* it may be impossible. In such cases the proper procedure is to wait for a few weeks and then repeat the procedure.

8. The great majority of cervical lesions is obviously benign or obviously malignant, so that biopsy and microscopic differentiation need be invoked in only a small proportion, probably considerably less than 5 per cent.

9. If the pars vaginalis is normal in appearance, but the intracervical mucosa seems vascular or granular, the curette may reveal definite intracervical cancer, most often adenocarcinoma.

10. By a careful weighing of the clinical history, the naked-eye picture of the disease, and, where necessary, the microscopic findings, cancer will rarely be overlooked, even in its very early stages.

11. If, as most often is the case, the suspicious lesion is found to be benign, it should be eradicated by whatever method is best suited to the individual case. Usually some simple procedure, often of the office type, is sufficient. These lesions unquestionably predispose to cancer, when combined with the still unknown factor of individual susceptibility. Their eradication is the one important contribution we can make to the direct prophylaxis of cervical cancer.

12. From the standpoint of the general profession, the great need is a readjustment of the clinical concept of cervical cancer so as to include the early pictures as well as, and even more than, the later ones. This is a contribution which the public has a right to expect of us, if we are to continue our efforts to educate women as to the early warnings of cancer. Let us practice as well as preach!

THE SURGICAL INDICATIONS FOR SYMPATHETIC GANGLIONECTOMY AND TRUNK RESECTION IN THE TREATMENT OF CHRONIC ARTHRITIS[1]

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SINCE numerous patients with chronic arthritis present a syndrome of vasomotor disturbance similar to that of Raynaud's disease, it occurred to us that the same type of surgical treatment employed in Raynaud's disease might prove of value in chronic arthritis. We do not propose any change in the treatment of acute arthritis, nor have we had sufficient experience to draw definite conclusions concerning all types of chronic arthritis. However, we have accomplished some satisfactory results with sympathetic ganglionectomy and trunk resection in the treatment of the peri-articular type of chronic arthritis, and these results we wish to report.

ANATOMY AND PHYSIOLOGY

The muscular tone and caliber of the arterial system are governed chiefly by the sympathetic nervous system. Its central origin is supposed to be in the diencephalon. The impulses then pass along tracts through the brain stem and spinal cord to be transmitted along neurons, the corresponding cell bodies of which are in the lateral column of the gray matter of the anterior horn. These neurons are known as preganglionic white rami communicantes. They terminate in synaptic relations with the cells in the sympathetic ganglia. The impulses are distributed from the ganglia by postganglionic fibers known as gray rami communicantes. Those of the preganglionic fibers which carry impulses to the viscera communicate directly with thoracic ganglia and postganglionic fibers, or go to make up the splanchnic nerves and terminate in the cœliac ganglion to be redistributed as postganglionic fibers. The innervation of the arteries, pilomotor muscles, and sweat glands of the extremities is carried from the thoracicolumbar sympathetic ganglia by postganglionic, gray fibers back into the spinal nerves to be distributed in somatic relation corresponding to the musculocutaneous distribution of cerebrospinal nerves. The sympathetic nervous system also contains sensory fibers which have their ganglia in the spinal cord (Ranson). These fibers reach their destinations by way of the white rami. We would also like to believe that there are sensory fibers associated with the postganglionic fibers which innervate the vessels, as it is difficult otherwise to explain the sudden relief of pain following ramisection or ganglionectomy in the treatment of Raynaud's disease. Orbeli believes that the relief of pain following ramisection is due to lowering of the sensitiveness to pain.

Since some muscular tonus still exists in the arterial wall after interruption of the vasomotor sympathetic nerves, Bayliss has suggested that this tonus is maintained by dilator fibers which travel anti-dromically along the sensory spinal nerves. Davis and Kanavel have made the suggestion that it might be due to cerebrospinal innervation of the arteries. Orbeli believes that muscular tonus of the smooth muscles following section of the sympathetic fibers is maintained by the chemical reaction of the plasma. Leriche believes that an intramural ganglion and neurons must exist in the wall of the arteries. As yet there is considerable speculation as to the existence and functions of nerves other than the vasoconstrictor nerves to the arteries.

OPERATIVE MEASURES

Jaboulay and Leriche are responsible for proposing and performing peri-arterial sympathectomy in the treatment of painful gangrenous conditions of the extremities. They

[1] Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

assumed the innervation of the arteries to be centrifugal in distribution, or if not centrifugal, then centripetal, since there appeared to be temporary relief of the side that had not been subjected to operations. But the anatomical work of Kramer, Todd, and Potts demonstrated that the distribution was somatic and corresponded with the cerebrospinal musculocutaneous innervation. Leriche obtained temporary improvement in the extremities, the nerve supply of which had not been operated upon. One of us (Adson) explains this fact as being due to influences of postsurgical fever and temporary paralysis of the sympathetic nervous system as a result of the general anæsthetic. Royle's ramisection for spastic paralysis stimulated several neurological surgeons to try the procedure for spastic paralysis, but it was soon learned that the temperature changes following the operation were of more clinical value than the operation for spastic paralysis. One of us (Adson, 1) discovered that it was easy to overlook rami in attempting to section them and proposed and carried out complete removal of the second, third, and fourth lumbar ganglia without complication, thus removing the lumbar sympathetic trunk and interrupting all of the gray rami below the first lumbar ganglion. It is true that the efferent sympathetic outflow does not enter the lumbar sympathetic ganglia below the second lumbar ganglion, but it is wiser rather to do more than is necessary than not to do enough, when an attempt is made to paralyze the vasomotor control of the arteries of the lower extremities. Sympathetic lumbar ganglionectomy and trunk resection not only produced immediate increase in surface temperature of the lower extremities but maintained the increase of surface temperature. This has been verified by repeated examination of patients over a period of more than 4 years after operation. When these phenomena became established, Adson and Brown (1) applied the procedure in the treatment of Raynaud's disease and found it to be successful. The results were verified by Diez, Davis and Kanavel, Fulton, Royle, and others. Thereafter, cases of allied vasospastic disorders, such as thrombo-angiitis obliterans with spasm of the collateral vessels, scleroderma of vasospastic origin, and chronic arthritis with similar vasomotor disturbances, were treated by the same procedure.

The treatment of vasospastic disorders of the upper extremities was more difficult. Bruening reported a cure of Raynaud's disease and scleroderma by performing a Jonnesco operation, removing the stellate ganglion. But we did not produce cure when we performed the Jonnesco operation; nor did cure occur when we combined the Jonnesco ganglionectomy and the Royle (20, 21) cervical ramisection in the treatment of Raynaud's disease. It was apparent that the anterior approach to the cervicothoracic ganglion did not afford sufficient exposure to allow interruption of all of the efferent vasoconstrictor impulses. Therefore, one of us (Adson, 2) carried out a posterior thoracic approach which permitted section of the thoracic sympathetic trunk below the second thoracic ganglion in addition to removing all of the second and first thoracic and the lower cervical sympathetic ganglia. This procedure completely interrupted all of the efferent vasomotor impulses to the upper extremities, head, and neck, thus producing the same satisfactory result previously accomplished in the lower extremities.

SELECTION OF CASES

In selecting patients suitable for operation, we have chosen only those who seek relief for a disease that is progressive, who have failed to respond to the accepted types of treatment, such as removal of foci, immobilization, massage, and exercises, and who present the vasospastic syndrome that is temporarily relieved by baking, diathermy, and vaccines. Thus far we have not included the group of patients with arthritis due to specific disease, such as tuberculosis, gonorrhœa, or syphilis, nor have we included those patients who present destructive ankylosis. It is probable that surgical procedures may be indicated in some of these patients who are suffering with hypertrophic and destructive changes; if so, the objects would be to relieve pain, to check the disease, and to assure better results from arthroplasty by improving the circulation.

The patients we have chosen are those who complained of painful, swollen, tender joints

associated with limited motion, atrophy of muscles, and loss of function, and who also complained of cold extremities, mild acrocyanosis, excessive perspiration, and aggravated symptoms during stormy weather. One of our patients described her feet and legs by saying that they felt like dead fish, thus effectively describing the cold, clammy skin of the extremities.

In order better to select suitable cases for operation, we submitted all of these patients to vascular studies to determine the presence or absence of vasospasm or obliterative lesions of the arteries. It is essential to know whether or not the main arteries or the collateral arteries are patent and capable of relaxation if robbed of their vasomotor control. This is determined by Brown's "fever test," which consists in making simultaneous readings of mouth and skin temperatures following the administration of a foreign protein. In a normal person, or in one suffering from a vasopastic disorder, the skin temperature over the digits will increase several times more than the increase of the mouth temperature, whereas it will be observed that in patients with arterial sclerosis or occlusive lesions, the surface temperatures of the extremities are rarely much above the increase of the mouth temperature. We have also observed that the maximal increase of skin temperature over the extremities during the test is reproduced by ganglionectomy and trunk resection; therefore, this test serves as an index, and unless the rise in temperature of the skin over the digits is two or more times greater than the rise of the mouth temperature, the patient is considered unsuitable for operation. If the fever fails to relax the arterial tension, so will the operation fail, because of occlusive lesions or permanent changes in the arterial wall.

REPORT OF CASES

CASE 1. A woman, aged 34 years, a stenographer, had arthritis deformans of all joints of the upper and lower extremities, of 6 years' duration. The condition had resisted all forms of medical treatment. The extremities were cold and clammy, were bathed in sweat, were mottled and cyanotic in appearance, and exhibited marked swelling about the joints. Changes ordinarily considered trophic were very marked: atrophy of the muscles, thin, shiny skin, and ridged, thin, brittle, and pitted nails. Bilateral lumbar ganglionectomy was performed in June, 1926. There was prompt and complete disappearance of all signs and symptoms of arthritis in the lower extremities. At that time we did not advise operation for the condition in the upper extremities since we had not developed the posterior approach to the cervicothoracic ganglia.

The patient was sent home but returned in October, 1928, at which time she reported that she had experienced complete cure of the arthritis in her legs. The word "cozy," she said, described her sensations from the waist down during the 2½ years intervening since operation. The legs had been comfortable throughout the whole period, with a pleasant sensation of warmth. She had not had pain, tenderness, redness, or swelling of the joints concerned, although at times she had noticed a little tendency to puffiness of the soft tissues, especially about the ankles. In her home town in northern Canada she had walked to and from work throughout the cold winters without at any time experiencing even a suggestion of a recurrence of the arthritis. On the other hand, throughout this entire period she had suffered extreme discomfort in all the joints in both upper extremities. The arthritis had relentlessly pursued its disabling and crippling course until she had been reduced to the necessity of doing all her typewriting with one finger. She stated that after the first operation she had gone back to work 3 days after arriving home, had worked steadily for more than a year, and then, as the result of continuous pain in the joints of the arm, had had a nervous breakdown for which she had been sent to California. She had returned to work in February, 1928, and had worked every day until she had left for the Clinic. The condition of the shoulders, elbows, and hands had been constantly growing worse. She stated that she had not had a good night's sleep in 3 months because of continuous pain in the joints of the upper extremities. This pain always had been present but had undergone acute exacerbations with every storm. The limitation in motion in all the involved joints had become decidedly more marked and there had been some contraction deformity of the ring finger on the right hand; at times, the joint became locked. Because of the marked progress of the disease in the upper extremities, she had returned to the Clinic with considerable joy when the possibility of cervicothoracic sympathetic ganglionectomy had been suggested to her.

The patient was up and around the Clinic and hospital, and active on her feet, walking everywhere without discomfort. Her weight was 112 pounds (51 kilograms) and the blood pressure 122 systolic and 87 diastolic, measured in millimeters of mercury. On general examination, it was apparent that changes had taken place in the hands in which the arthritic process had progressed. The hands were now typical of an advanced stage of arthritis deformans. There was considerable swelling of the

metacarpal, phalangeal, and interphalangeal joints of the fingers, especially of the proximal row, and there was atrophy of the intrinsic muscles of the hands. There was beginning ulnar deflection of the hands and fingers. The hands were extremely cold, especially the fingers, and the palms were continuously wet with perspiration, so that the patient was constantly drying them with her handkerchief. A fine film of moisture, suggestive of dew, almost always could be observed over the palms. There was cyanosis from the transverse lines down into the fingers. The hands were cold and clammy. She had no grip in either hand. The fingers felt like useless appendages rather than purposeful or useful organs. The fingers, also, imparted a breast-like or lipomatous sensation to the palpating hand. There was a contraction deformity of the ring finger on the right hand. When the hands were raised toward the chin, there was considerable ulnar deflection, and the fingers dangled. When the patient attempted to raise the hands and spread the fingers, there was coarse, marked tremor. She was unable to make a firm fist with either hand. In the upper part of the arms there was evidence of loss of subcutaneous tissue, and the muscles lacked tonus. She insisted that part of her inability to raise her arms was due to sheer muscular weakness and not to limitation occasioned within the joint. Movement was decidedly limited in the fingers, wrists, elbows, and shoulders and resulted in distinct pain. The skin of the arms seemed atrophic and shiny in appearance.

By contrast, the lower extremities were now shapely and firm, with abundant subcutaneous tissue. Their appearance did not suggest arthritis in the least. There was no pain on movement. With shoes on, the patient could walk on either her heels or her toes. There was bilateral pes planus. Slight grating in the knees and the left ankle remained; however, it was not accompanied by pain. The toenails appeared normal, the feet were warm and dry, and the skin was normal in appearance and texture. It was difficult to believe that she had ever had any arthritis in the legs.

In view of the satisfactory results obtained from bilateral lumbar ganglionectomy, we felt justified in advising a similar procedure for the upper extremities. Bilateral cervicothoracic ganglionectomy was performed November 23, 1928. At this time the lower cervical, and the first and second thoracic sympathetic ganglia, along with the intervening trunk on both sides, were completely removed through the dorsal mediastinal approach. The operation has been described in previous papers (16, 17, 18).

Immediately following the operation, the patient's hands became dry and warm, and presented a normal, pink color. She noticed immediately that she could make a fist and grip a visitor's hand. She experienced severe burning pain at the operative site over a period of several weeks. This was probably due to operative trauma to the intercostal nerves. Hyperæsthesia developed over the inner aspects of both arms and about the lower and inner aspects of the scapulæ. This slowly disappeared. She also complained of a peculiar, continuous pain in the hands and arms which was different from that of arthritis. This was demonstrated to be erythromelalgic in character and it cleared up immediately when the arms were raised slightly and supported a little above the level of the body. This also disappeared entirely in the course of from 2 to 3 weeks. Bilateral Horner's syndrome also had developed. There was slight drooping of the eyelids, and the pupils were small and did not dilate with cocaine. Neurological examinations showed that no other nervous anomalies could be detected in relation to touch, pain, vibration sense, and stereognosis.

Early after operation the patient had slight arthritic pains occasionally in the upper extremities, so that physical therapeutic measures were instituted, but before she had left the hospital she was satisfied that the pains of arthritis had entirely disappeared from all her joints. She was entirely transformed in appearance. The pinched, drawn facies and the dark circles under her eyes had disappeared and given place to a happy and contented expression. The strength began to return to the hands immediately following the operation. The swelling rapidly subsided, and the tremor of the hands and fingers, which formerly was so evident during attempts at movements of the hands, lessened materially. The skin of the hands and arms became dry and slightly suggestive of ichthyosis, but this condition soon disappeared.

The sweating mechanism was disturbed. It was anomalous in distribution; sweat was almost entirely lacking over the extremities and rather marked in quantity over the chest, abdomen, and back. With the administration of pilocarpine hydrochloride, however, sweating could be induced over most of the body.

There was striking elevation of the temperature of the hands. The changes in temperature of the hands, following cervicothoracic sympathetic ganglionectomy, were almost identical with those observed previously in the feet, following lumbar sympathetic ganglionectomy. The increase in the temperature of the feet has been fully sustained over a period of nearly 4 years. The increased temperature in the fingers was accompanied by alteration in capillaries as reflected in those seen in the nailfolds. There the capillaries were easily visualized owing to excellent transparency of the skin. They had sharp margins and a rapid flow of blood without stasis. The collecting venules, also, could be clearly visualized.

The patient was dismissed, January 7, 1929, to visit some friends, and promised to return for reexamination before returning to her home. At this time the symptoms associated with the active arthritis had practically ceased. However, she still complained of tenderness and pain between the shoulder blades in the region of the surgical wound. This pain was severe enough at the time of her dismissal to require an occasional dose of codein.

During the patient's visit "sniffles" developed, a condition of moisture of the nasal mucous membranes which has been seen on several occasions following this operation. It proved to be of little, if any, consequence. There was also a return of slight pain of an arthritic nature in both wrists and in the right elbow and the shoulder. She could move her arms rather freely, comb her hair, and wash her ears, a privilege that had been denied her for several years. She said that her wrists "locked" occasionally and that some tremor persisted which made her somewhat awkward in the use of her hands.

On the patient's return at the end of March, the arms and hands appeared much improved. There was much better muscular tonus in the upper parts of the arms and less wasting of the intrinsic muscles of the hands. The hands and fingers had lost their swelling and were more shapely. The ulnar deflection of the fingers had almost disappeared, but it was still noticeable, especially when she spread her fingers and raised her arms. Distinct, but greatly diminished, tremor was also present in the performance of this act. The hands were soft, perfectly dry, and very warm. There were no sore places in any joints from the wrists down. The nails (marked with silver nitrate at the margin of the fold at the time of the operation) were more healthy in appearance, with less ridging and fewer indentations. The new part of the nail was entirely normal in appearance.

Naturally we were interested in the roentgenographic disclosures but they showed little of interest. The roentgenographic report of the examination of November 15, 1928, stated that there was marked atrophy of the hands, with destructive changes in the radiocarpal and carpal joints and various joints of the hands. The final examination, March 18, 1929, showed peri-articular arthritis of the hands and wrists, contraction deformity of the fingers, and some atrophy of the right elbow and shoulder joints. The bony changes throughout were extremely slight and the roentgenologist, on comparing the two series, stated that he could not see any essential difference between the first and last series.

At the time of dismissal of the patient, April 9, the general examination did not reveal anything new. The Horner's syndrome persisted, but the pupils dilated markedly and promptly when atropine, 0.0022 grams (1/30 grain), was administered. She weighed 16 pounds (7 kilograms) more than on the first admission. The blood pressure was entirely normal in all extremities. There was still a slightly painful area over portions of the right scapula. She later reported by letter that she continued to improve and was gradually being relieved of her shoulder pain.

COMMENT

The results observed in the case reported here, following sympathetic ganglionectomy, reveal the fact that in certain types of arthritis, the sympathetic nervous system of the extremities is hyperactive, producing marked vasomotor disturbance and profuse sweating, and possibly contributing to the spasm and atrophy of the muscles with the resultant deformities (17, 18).

CASE 2. A girl, aged 16 years, the daughter of a Greek sheep herder who lives in the mountains of Utah, was well until 26 months before she came to the Clinic. Then, for no known reason, pain appeared in the feet on walking. The pain was intermittent, but never failed to return each day, and became progressively worse. Within the next month her knees, also, began to ache. About 14 months after the onset, her hips became affected similarly, and her feet began to swell. Her back had not ached, except low in the sacral region. She had not been able to walk a step for 6 months prior to admission, partly because of pain and partly because of weakness in the legs. The pain was worse on motion.

The patient was brought into the Clinic building in a wheel chair. She weighed 89 pounds (40.5 kilograms), whereas her normal weight had been 114 pounds (51.8 kilograms). Her height was 5 feet 2 inches. She was pale, emaciated, and entirely incapable of walking or standing. The tonsils had been removed previously; small tags remained. Except for a slight, systolic, apical murmur, examination of the heart gave negative results. The blood pressure in millimeters of mercury was 135 systolic and 80 diastolic when she was examined at the Clinic. Determination of blood pressure taken during her stay in hospital ranged from 118 to 122 systolic and from 68 to 80 diastolic. The pulse rate was 100 beats each minute and the temperature 99 degrees F. There was marked atrophy of the muscles of both legs. Weakness of flexors and extensors of both legs was extreme, but it was more marked in the left leg. The extensors of the ankle were exceedingly weak. Swelling of both feet and both ankles was graded 3 and swelling of the knees was moderate. There was moderate bilateral talipes equinovalgus with hallux valgus and spasms of both psoas muscles. Sacral kyphosis was marked, and there was rotation of the torso to the right, flexor deformity of the left hip, and arthritis affecting the sacro-iliac joints. Reflexes of the ankles and knees were hyperactive. The rigid flat feet could be moved only with the greatest difficulty and they were swollen, cold, clammy, and bathed with perspiration.

The clinical diagnosis was chronic infectious arthritis. Preferably, perhaps, the condition might have been diagnosed as chronic peri-articular arthritis, and at the same time the evidence of vasomotor disturbance in the lower extremities might have been emphasized. Evidence of focal infection could not be found in the nasopharynx, sinuses, teeth, or pelvis. The small, tonsillar tags have been left in place, but, of course, they should be removed later. Roentgenographic examination revealed hypertrophic arthritis of the sacro-iliac joints and lower lumbar

vertebræ. There was some bony atrophy in the right knee. Because of the extreme atrophy and weakness a neurological examination was requested. This examination was considered clinically negative except for atrophy of the muscles and weakness as a result of the patient's stay in bed. The movements of the patient's limbs when sitting or lying were relatively good. On standing, however, she could not extend her thighs on account of spasm of the muscles, and she was afraid to bear her weight because of pain.

The patient was placed in hospital and physiotherapy was instituted. This has been continued, except for a week or 10 days immediately following operation. On March 30, 1929, both hips were brought down to full extension and Buck's extension applied by an orthopedic surgeon. On April 22, 1929, bilateral lumbar sympathetic ganglionectomy was performed. The second, third, and fourth lumbar sympathetic ganglia, with the intervening trunks, were removed from both sides without difficulty. The patient's feet, previously cold and sweaty, were warm and dry when she left the operating table and a good prognosis was given.

Recovery was uneventful. The course throughout has been entirely afebrile. The feet remained warm and dry and devoid of any suggestion of pain. During the first 3 weeks following the operation, the patient improved constantly, the swelling disappeared, and she could move her ankles, knees, and hips freely, without pain. The extremities were always comfortably warm and dry. She did not experience pain in the feet, ankles, knees, or hips, but complained of pain in the muscles of the thighs. This she said was not the same pain she had before the operation, but was more like the stiffness and soreness she had experienced at times after playing ball or jumping rope before she was sick. It is a peculiar muscle pain which we have seen in all cases of arthritis when the patient resumes muscular activity.

The patient walked around the bed, holding to its sides, 3 weeks after the operation. Two or 3 days later, she walked with the aid of two canes, and after another day or so, with one cane. Within 5 weeks after the operation, she took a few steps without any assistance whatsoever. Now, 6 weeks since operation was performed, she can walk unassisted a distance of 100 feet or more, without experiencing pain of any kind.

The vasomotor index for the finger before operation was 2.2 and for the toe, 5.3. The elimination of heat in the left foot was measured before and after operation. Before the sympathetic ganglionectomy the amount of heat imparted to the water in which the foot was immersed was 0.31 calorie each minute for each square inch of surface of the foot. Following the operation, it increased to 2.8 and the foot was still warm when it was removed from the bath at the end of 35 minutes. The surface temperature of the feet before operation ranged from 23 to 27 degrees centigrade; since the operation, the temperature has been about 32 degrees centigrade.

The patient, like the patient in Case 1, has made favorable progress. She has shown her ability to walk with two canes, then with one cane, and finally without assistance. She also has demonstrated the flexibility of her ankles, knees, and hips. The lower extremities are pink, warm, and dry. She claims that her joints are entirely free from pain and have been since the day of the operation. The atrophy and weakness of the muscles, however, still is striking. A report 4 months after the operation stated that she could dance and could walk a distance of two squares (18).

CASE 3. A woman, aged 44 years, came to the Clinic November 7, 1928, complaining of painful swollen joints, involving the feet, ankles, knees, fingers, hands, wrists, and shoulders, which had begun 11 months previously. She had had dilatation and curettage in December, 1927, following which the symptoms apparently began to develop. There were associated marked weakness and septic fever. The left lower extremity, especially the knee, became involved first, and in July, 1928, the right lower extremity also became involved, causing the patient to be bedridden for the 3 months previous to registration. She had had tonsillectomy and extraction of a tooth in September, 1928, after which apparently her hand began to be affected. When the patient was admitted to the Clinic, she had diffuse infectious chronic polyarthritis and was running a septic temperature daily of 1 to 2 degrees F.

On examination, the patient was found to be bedridden. The skin over the extremities was pale, soft, flabby, cold, and wet; there was marked swelling about the joints without apparent effusion; the feet were somewhat œdematous. The systolic blood pressure was 98 and the diastolic was 80 measured in millimeters of mercury; the pulse rate was 132 and the temperature was 100.2 degrees F. Urinalysis was negative. The hæmoglobin was 36 per cent; the erythrocytes numbered 2,570,000, and the leucocytes, 4,600. The Wassermann reaction of the blood was negative. Gastric examination showed total acidity of 22, but no free hydrochloric acid. The tonsils had been removed; there were some irregularities in the septum; the ears were normal. Roentgenograms of the extremities did not reveal bony change in the joints; the process apparently was peri-articular involvement of the soft tissues. Pelvic examination gave evidence of acute cervicitis with endometritis. In view of the history of infection and the septic temperature, it was suggested that steps be taken to remove the foci, and consequently orthopedic measures and physiotherapy were instituted. This treatment was carried on for a period of approximately 7½ months. During this period, repeated blood transfusions were given and more or less continuous physiotherapy consisting of the application of heat and gentle massage. For a certain period, casts were applied to the lower extremities with the idea of immobilizing the joints; also, zinc chloride

was applied to the cervix and uterine canal, all of which afforded little, if any, relief; low-grade septic temperature continued.

Because of the vasospastic phenomena, vascular studies were carried out, with the result that the index was found to be very high, and in view of experience in the treatment of polyarthritis of a similar type, bilateral cervicothoracic ganglionectomy by the posterior approach was performed May 29, 1929, at which time the thoracic trunks were resected and the second, first, and lower sympathetic ganglia were removed. Immediately after operation, the skin over the hands and arms became warm and dry, the patient was relieved of pain, and the function of the fingers, hands, and arms began to improve. It was not long before the muscular spasm disappeared and the patient was able to move her elbows and to lift her arms above her head. The progress was more or less phenomenal because the patient had failed to respond to the usual types of treatment, and because the fever, which had continued until the operation, subsided completely within 10 days following ganglionectomy. She was dismissed 44 days after operation to recuperate at home and to return later for lumbar sympathetic ganglionectomy.

COMMENT

This patient, like those in Cases 1 and 2, represented a syndrome of chronic polyarthritis of the peri-articular type with vasospastic phenomena which failed to respond to the usual medical treatment, but which immediately began to show marked improvement following the improved circulation resulting from sympathetic ganglionectomy. The unusual feature in this case was that symptoms followed a history of infection and that a septic temperature continued after the foci were removed. Apparently, the temperature was influenced by some local process involving the upper extremities which subsided following the change in circulation. The swelling about the joints had begun to subside gradually, and I believe it will slowly disappear, and that a satisfactory recovery will result. Further detail in this case will be reported when the patient returns in 3 or 4 months for operation on the lower extremities.

CASE 4. A man, aged 26 years, registered at the Clinic, April 29, 1929. His early life had been uneventful, except for pneumonia at the ages of 3, 9, and 13 years. In 1917, when the patient was 14 years of age, for no known reason, acute pain with redness and swelling developed in the left ankle. The condition lasted for a few days and then disappeared but was prone to return after exercise and in bad weather and was sufficiently serious to interfere with walking. The pain and swelling continued to return at frequent and irregular intervals until 1925, when the right knee became similarly affected, and in 1926 when the right wrist became affected. Following operation on the right knee, performed in January, 1928, the right ankle, left knee, and right wrist became acutely involved and the lymph nodes in the groin began to enlarge and to show signs of an acute inflammatory process. The history from 1917 to 1928 was one of recurring attacks of an acute form of arthritis affecting the knees, wrists, and ankles. Treatment had been very extensive, including removal of infected teeth and tonsils, baking, hot applications, intravenous injections of typhoid vaccine, intramuscular injections of milk, autogenous vaccines prepared from cultures from an inguinal lymph node, diet, casts, and massage, all of which did not in any way stem the onward progress of the disease.

The patient was anæmic and emaciated. He was lying in bed on his back with both hips and knees in flexion. Pupils reacted normally to light and accommodation. The tonsils had been cleanly removed and the teeth showed some cavities and dentures. The thorax and abdomen appeared to be normal. The left ankle was swollen and motion was limited; the right ankle appeared to be normal and motion was good. There was much peri-articular swelling around the knees, which were flexed at an angle of 115 degrees; the right knee was practically fixed, and the left showed limited motion. Movement of left hip was definitely limited and it was held in a flexed position; the right hip was not affected. The lumbar portion of the spinal column showed lordosis with tenderness, but good movement. The right hand showed marked peri-articular swelling of the wrist and slight flexion deformity of the right elbow. The hæmoglobin was 72 per cent; erythrocytes numbered 4,200,000, and luecocytes, 5,100. The blood pressures averaged about 90 systolic and 50 diastolic, measured in millimeters of mercury. The Wassermann reaction of the blood was negative. Roentgenograms of the teeth showed two partially erupted molars, but definite evidence of infection was not found. Roentgenograms revealed a destructive type of arthritis of both hips with atrophy; also, marked atrophy of the right knee and arthritis with atrophy of bone of both ankles and the right wrist and elbow. Roentgenological examination of the thorax was negative. The vasomotor index of the left great toe was 2.5; of the left second toe, 7.1; of the right great toe, 5.9; and of the right second toe, 6.2.

Inasmuch as the patient had had recurring attacks of arthritis with deformity and atrophic changes in many of the joints for 12 years, and had run practically the whole gamut of medical treatment for arthritis, without appreciable decrease in the activity of the process, it was felt that radical procedures should be carried out as soon as possible. Consequently, after a thorough study of the case and a brief period of medical treatment, bilateral sympa-

thetic ganglionectomy and trunk resection were performed June 3, 1929. Immediately after operation, the feet became warm and dry, and they could be moved without pain. Slight pain continued in the knees and hips, but this gradually disappeared, and on the ninth day the patient was able to be up in a wheel chair, although he complained of considerable pain in the muscles of the thighs; however, the pain was different from the former arthritic pain. Recovery was slow, because of a slight infection in the wound, but on the thirty-sixth day after operation, he was able to get on his feet. The joints were not painful, but he complained of pain in the muscles and tendons. Occasionally, he experienced arthritic pain in the hips and knees before storms. Ganglionectomy was difficult and prognosis questionable because of the osteo-arthritic process which had developed within the hip-joints.

COMMENT

No doubt, this case falls in the group of chronic polyarthritis of the peri-articular type, but apparently the process had lasted so long and was so severe that destruction and hypertrophic changes had occurred in the hips which may never respond to improved circulation. However, since so many patients are seen who manifest osteo-arthritic changes preceded by this vascular phenomenon, we felt justified in submitting the patient to surgical procedure, for it may prove of value in assisting the end-results of arthroplasty because of the improved circulation which has developed following ganglionectomy. Definite conclusions cannot be drawn in this case, but, as time goes on, it will be possible to judge whether or not surgical procedure is indicated in cases of this type.

CASE 5. A woman, aged 21 years, was admitted to the clinic July 23, 1928, giving a history of chronic polyarthritis of 4½ years' duration. The onset had followed acute abdominal cramps, chills, fever, nausea, generalized pain in all joints, and swelling in the left knee. It was thought that she had acute appendicitis, but because of some dyspnœa, the heart was believed to be affected and, therefore, she was advised not to have appendectomy. The abdominal symptoms soon disappeared, but the pain in the knee continued, and during the next year other joints were affected. Approximately 3 years before admission, tonsillectomy had been performed, following which she had a stormy convalescence and had been in bed more or less ever since. She also gave a history of attacks of dyspnœa, fainting, and stabbing pains over the heart which radiated to the shoulders and arms.

Examination gave evidence that the patient had cystitis, and the previous abdominal pains were attributed to this rather than to the appendix. The patient was bedridden, and the hip, knee, and ankle joints were swollen, painful, and immobile. She immediately was placed under the usual treatment for infectious arthritis, which included massage and heat by various electrical appliances. Examinations of the urine and blood were negative. The Wassermann reaction of the blood was negative; the basal metabolic rate was minus 4; the function of the kidney was normal. A small cervical polyp was found, associated with slight cervicitis, for which treatment was given. Roentgenograms of the thorax and of the thoracic portion of the spinal column were negative; there was some blurring of the articular margin of both hip joints, but otherwise the joints were normal. Electrocardiographic examination revealed sinus tachycardia. Again the patient was placed under the usual treatment for 11 months. At first, *brisement forcé* for arthritis of the hips was applied, with casts, in the hope of straightening the deformity. Physiotherapy was instituted. The cervical polyp was removed. The patient remained more or less an invalid.

Vascular studies were made which gave an index of 4.2 on the right great toe and 3.8 on the left great toe, with an index of 2.6 on the right index finger, all of which suggested a vasomotor phenomenon, even though the skin was not as moist or as cold as is usual in cases of this type. The arthritic process was more or less limited to the lower extremities, with cessation of activity in the upper extremities. Astasia-abasia was unquestionably present, but even with this functional element the patient had been confined to her bed for 3½ years without any apparent improvement, and anything that might offer relief was indicated. Bilateral lumbar sympathetic ganglionectomy and trunk resection was performed June 18, 1929, with astonishing results. The pain in the feet, ankles, and knees subsided immediately, the skin became warm and dry, and within 3 months the patient, with the aid of additional massage and passive motion, was able to move the ankles and toes in full range of motion, and could flex the knees to an angle of 45 degrees. At first she was able to walk with assistance; now she is able to walk 50 steps without assistance. There is still considerable limitation of motion in the hip associated with pain, so that arthroplasty may be necessary. Time alone can tell the degree of improvement that will be obtained. It is doubtful if as much will be accomplished as in the true peri-articular types in the early stages without osteo-arthritic changes.

CASE 6. A woman, aged 34 years, registered at the Clinic June 24, 1929, complaining of chronic polyarthritis of 10 years' duration. After an epidemic of influenza, she, her mother, and a brother had had arthritis; the brother recovered 1 year after the onset; the mother's disease continued until death. The patient's arthritis appeared to increase for 2 or 3 years, and then remained stationary for a

time; again it increased in severity, and continued so for 3 or 4 years previous to her coming to the Clinic. With the arthritis, unconscious attacks developed, beginning with chilliness and numbness. Following these attacks, she noticed that the extremities were cyanotic and her head ached severely. The last few attacks had been associated with jerking sensations, suggestive of a convulsive seizure.

The patient had bilateral bunions, and the toes were deflected laterally under the other toes, with marked callous formation. The ankle-joints were swollen and painful, and there was 50 per cent limitation of motion. The right knee was mobile but tender, and the left knee was swollen, with slight limitation of motion. The hips and spinal column were apparently free from involvement. There was tenderness over the right shouder, but no limitation of motion; motion of the left shoulder was limited to 75 per cent. There was slight flexion deformity in the left elbow, with 15 per cent limitation of motion and some tenderness. The right wrist was in a slightly fixed position, and the left wrist motion was limited to 50 per cent. The fingers of the left hand were not deformed, but motion was limited so that they could not be flexed sufficiently to make a fist; the fingers of the right hand had both deformity and fixation. The patient complained mostly of the feet, ankles, and knees, since they interfered with her activity; she was able to walk in a hobbling sort of fashion, but was unable to climb stairs and was constantly troubled with pain and tenderness. The tonsils had been removed. The urine was normal; the blood was normal except for slight anæmia, the hæmoglobin being 64 per cent; the erythrocytes numbered 3,890,000, and the leucocytyes, 6,200. The Wassermann reaction of the blood was negative. Roentgenograms of the spinal column were negative. Cultures were made from the cervix and Gram-negative bacilli and a few streptococci were found, but there was no evidence of cervical erosion or endometritis. The systolic blood pressure was 120, and the diastolic 80, measured in millimeters of mercury; the temperature was 98 degrees F. and the pulse rate was 88. There was a history of chronic deafness, on the left side, the result of previous infection; a roentgenogram of the left mastoid showed cloudiness. Roentgenogram of the thorax was negative; that of the elbows showed peri-articular arthritis; that of the hands, destructive arthritis of the phalangeal joints, with deformity and calcareous spurs; and that of the lower extremities, peri-articular arthritis of the ankles and knees. A diagnosis was made of progressive deforming arthritis with destructive changes, associated with vasomotor disturbances and an increased vascular index.

Because of the long history and the thorough trial of physiotherapy and orthopedic measures, without much improvement, the patient was advised to have bilateral sympathetic ganglionectomy, with postponement of the operation for the upper extremities. The operation was performed July 23, 1929. The bunion on the right foot and the hammer-toe on the left foot were also operated on. The patient's convalescence was rather stormy, because of the development of postoperative ileus, but this finally adjusted itself, and recovery was satisfactory. The pain had practically disappeared in the feet, ankles, and knees by the time the patient was dismissed from observation, which was approximately 8 weeks from the time of operation. She was able to walk much more freely and could walk upstairs, which she had not been able to do for several years.

COMMENT

Further time must elapse before this patient obtains maximal improvement. An accurate prognosis with regard to results in joints with marked osteo-arthritic processes cannot be given, but we are impressed with the fact that if these patients are operated on earlier in the course of the disease, it is likely that the osteo-arthritic processes may be forestalled, and, therefore, there is justification for operating in some of these border-line cases.

SUMMARY

In summarizing the fundamental factors that produce chronic arthritis, we quote from Bankart's recent article:

"During life the joints are not passive pieces of mechanism but living structures which react to use like other living tissues. Every functional use of a joint is in a sense an injury, that is, friction and pressure tend to wear away the opposed articular surfaces. This normal wear and tear is at once made good by increased blood supply and nutrition which always accompanies function in normal tissues; hence the balance between wear and repair is dependent upon an adequate vascular response to function. If for any reason the vascular response in a joint is deficient, so that the process of repair is not equal to the demands made upon it, the joint simply begins to wear out and the cartilage becomes worn away where the friction and pressure are the greatest. But the products of degeneration act as irritants to living tissues, so that in addition to degeneration in the center of the joint there is also irritation, which makes itself evident in hypertrophic changes at the periphery where the blood supply is still abundant.

"Thus the characteristic features of osteo-arthritis are degeneration leading to atrophy,

erosion, and eventual disappearance of the cartilage in the center of the joint, and hypertrophy leading to the formation of osteophytis at the periphery."

Bankart's opinions, which are held by many observers, offer a practical explanation of the chronic arthritic process. Thus it is fair to assume that these chronic arthritic processes occurring in young persons with pliable arteries are due to circulatory disturbance of the vasospastic type and that we are justified in performing sympathetic ganglionectomy and trunk resection when the simpler methods fail. It is likewise important that the surgical procedure should be instituted early in the course of the disease, before bony changes have taken place, in order to obtain the maximal result from operation.

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DISCUSSION

Dr. Lewis J. Pollock, Chicago: We have seen that in certain carefully selected cases, sympathectomy has been followed by a gratifying amelioration of the suffering of patients afflicted with polyarthritis. A few questions present themselves to me:

1. Why has the number of such cases been so small?

2. What are the pathognomonic signs indicating cases suitable for this operative procedure?

3. Does the therapeutic result really mean that this type of polyarthritis is due to the disturbance in circulation, or is not the disturbance in circulation due to the arthritis?

Although forgotten by most of our confrères, the neurologist still remembers that in 1835 John Hunter first called attention to disproportionate weakness and atrophy of the muscles which occur as the result of some lesions of joints. These early observations were confirmed by a series of studies, by Gosselin in 1859, by A. Ollivier in 1869, and by L. Fort in 1872 and 1876. In 1872 Voltat presented in his inaugural thesis a clinical and experimental study and a detailed history of this reflex nervous disturbance.

Charcot, in 1883, in a study of the atrophies following lesions of the joints, showed that the atrophied muscles present a mere diminution of electrical excitability. He showed that "there is no necessary relation between the intensity of the joint affections and that of the paralysis and atrophy. . . . Months may elapse with the limb still useless, whereas the arthritis has for a long time only been manifested by a slight thickening of the peri-articular tissues, if,

indeed, there be even as much as that left. Not only was this atrophy and weakness of muscles noted, but Vulpian, in 1886, emphasized the neuralgias and pain, the trophic disturbances of the skin, hair, and nails, the secretory disorders, such as sweat, the coldness of the limb, and the cyanotic or dull pink color of the skin. One of the reasons that this has been forgotten is that such changes do not occur in all cases of polyarthritis but only in a very small number of them. Vulpian likewise found that all peripheral lesions, including frost bite, burns, and more or less deep wounds of the limbs, may become a starting point of such phenomena. Such disturbances, therefore, to use Dutil's expression, may have an articular or abarticular origin.

"In the late war, the distinguished French neurologists, Babinski and Froment, described a group of cases under the name of physiopathic reflex nervous disturbances. These cases presented contractures and paretic states which occurred after traumatism far removed from important nerve trunks. The lesions which produced them were very slight and out of proportion to the resulting disturbance of function. They differentiated these cases from hysteria by various symptoms which included muscular atrophy, hyperexcitability of the muscles, hypothermia, loss of vasomotor control (cyanosis, salmon pink tint), diminution in the amplitude of vascular oscillations at the periphery of a limb, secretory disturbances, and, lastly, trophic disorders of the bones, skin, hair, and nails. These disorders were included by Babinski and Froment in the nosological group originated by Hunter, occurring at times as the result of polyarthritis, at other times as the result of peripheral lesions. Although the pathogeny of these conditions was the subject of considerable controversy, at a special meeting of the Paris Neurological Society in 1916, it was concluded that nervous disorders exist quite distinct from hysteria and which are associated with real physiological disturbances of which the mechanism is still a matter of discussion which may be grouped with the reflex disorders observed after osteoarthritis lesions."

The meaning which Charcot and Vulpian gave to the term "reflex" may be gathered from the following: "The favorite theory," says Charcot, "with most contemporary writers appears to be this: The articular affections reflect certain irritant impulses along the articular nerves to the spinal cord, which impulses modify the trophic centers in that organ, whence emanate the motor nerves which regulate the nutrition of the muscles."

But can we explain by a reflex action all the phenomena which form part of the syndrome under discussion and especially the vasomotor and thermal disorders? Babinski and Froment had long been impressed with the importance of the vasomotor and thermal disorders in these conditions, which they felt indicated a disturbance of the sympathetic nervous system. A "reflex" pathogeny appears to them to explain all the peculiarities of the syndrome. Among the symptoms which constituted it, some, such as vascular spasm, are the direct result of a reflex action while others, such as the hyperexcitability of the muscles and slowness of the contraction, appear as an indirect result of the vasomotor and thermal disturbances. It is possible that the motor disturbances may depend either, as Charcot had supposed, on the state of the spinal motor centers, or on disturbances due to sympathetic vasomotor phenomena which are themselves of reflex origin. Not only do Babinski and Froment find no need to oppose the "reflex pathogeny to the sympathetic" pathogeny, but they point out that they harmonize with one another very well, the vasoconstriction being the result of a reflex action exercised through the sympathetic system. The symptoms of a reflex character result, therefore, from a peripheral lesion which causes disturbance in the spinal centers and in the sympathetic system simultaneously.

It is interesting to find in the description of these cases just such observations as Dr. Adson has noticed in relation to his cases of polyarthritis. The affected hand or foot is cyanosed, mottled, or a uniform salmon red tint; the slightest pressure causes a local ischæmia, and the white spot thus produced is slow in disappearing. Hypothermia definitely perceptible to the touch, and sometimes very pronounced, is associated with the vasomotor disorders. The difference in temperature between the affected limb and the sound limb is as much as 8 degrees C. in marked cases. The microsphygmia and diminished red cells, the damp skin which at times is macerated, at times beaded with sweat, the general atrophy, the trophic changes in the nails, all strikingly resemble the phenomena occurring in the cases benefited by sympathectomy. Babinski and Froment found that progressive improvement followed thermotherapy and Leriche performed a peri-arterial sympathectomy upon 3 such cases, all of which showed distinct improvement.

It would appear to me, therefore, that the type of polyarthritis which Dr. Adson has found may be successfully treated by sympathectomy is the type which exhibits symptoms corresponding to those described by Hunter, Charcot, and Vulpian as reflex disorders due to articular lesions, and by Babinski and Froment as due to abarticular ones. In both instances, the reflex disturbances of vasomotor and secretory character are mediated through the sympathetic nervous system and the sympathectomy is followed by an amelioration of all of the symptoms due to this reflex disturbance. The pathological state of the joint itself, as pointed out by Charcot, may, in contrast, be slight indeed.

This seems to me to be more logical than to attribute to the vascular change the function of the pathogeny of the arthritis, inasmuch as Dr. Adson himself, in describing some of these cases, called one an infective polyarthritis and another an arthritis deformans. The small number of suitable cases can then be more readily understood. The fact that exactly similar conditions occur when the joints are

not involved, and do not become involved after many months of persistent vasomotor and thermal change, bears out this opinion.

DR. S. W. RANSON, Chicago: The nerve impulses responsible for vasoconstriction in the leg leave the spinal cord along preganglionic fibers in the lower thoracic and upper lumbar spinal nerves. These fibers reach the sympathetic trunk through the white rami and end in the lumbar and sacral sympathetic ganglia, whence the impulses are relayed by postganglionic fibers in the gray rami to the nerves forming the lumbosacral plexus and thence to the blood vessels in the leg. Removal of the second, third, and fourth lumbar sympathetic ganglia absolutely blocks the vasoconstrictor impulses to the leg. In the same way the removal of the inferior cervical and first two thoracic ganglia completely blocks the vasoconstrictor pathways to the arm.

If it is true that there is a vasospastic type of chronic arthritis, ganglionectomy and trunk resection as practiced by Dr. Adson are the logical methods of treatment. The real question is a clinical one, "Is there such a type of arthritis?" and this is one with which I am not competent to deal.

But we may ask whether the vasodilation that results from severing the vasoconstrictor paths may not, by increasing the flow of blood even above normal, favorably influence various pathological conditions of the extremities which are not directly due to vascular spasm. This would depend largely on the length of time that the vessels remained dilated.

It is generally believed by physiologists that the vasodilation which results from section of the vasoconstrictor fibers is temporary and that the blood vessels quickly acquire a tone of their own quite independent of the nervous system. As an illustration, let me quote from a paper by Dr. Tower in the *American Journal of Physiology* for 1926. The paper states that the left stellate ganglion had been removed in dogs. "Immediately following the operation the blood vessels of the fore leg, neck and head were dilated on the side of the lesion. The whole leg felt hot and the paw pads, if lightly pigmented, appeared flushed as compared with the pallor of the normal paw. This condition persisted a very short time. In several days the vessels had regained tone appreciably, and after 10 days or 2 weeks there was usually no detectable difference in temperature or color between the two fore paws while the animal was quiet. From this time on the blood flow through the two fore limbs, as judged from paw temperature and color, was equal during rest, but in prolonged activity or in any condition attended by reflex vasodilation it was greater in the normal limb while conversely, in conditions attended by reflex vasoconstriction in this limb, it was less."

These observations support the opinion generally held today that after sympathectomy the dilated blood vessels quickly regain their normal size, though they no longer take part in vasoconstrictions or vasodilations of nervous origin. There is no evidence, however, that these observations of Dr. Tower, which were purely incidental and not the main object of the investigation, were made with great care; nor is the method of measuring the temperature recorded. This criticism holds for all the experimental work on this subject with which I am familiar. The skin temperatures have not been accurately measured with the thermocouple and the rate of heat elimination has not been determined in calories.

Moreover, there is some experimental work on record that supports the idea that the circulation may be speeded up for a long time after sympathectomy. Dale and Richards found that in the denervated limb of the cat, tone quickly returned to the capillaries, while the arterioles remained dilated throughout the 2 months that the animals were kept under observation. Because of the constricted capillaries, the skin was pale, but because of the dilated arterioles, the circulation was rapid, the skin temperature high, and the heat elimination great.

If it should prove to be true that the arterioles remain dilated for many months and the circulation is correspondingly speeded up in a sympathectomized limb, it would be reasonable to look for benefit from sympathectomy in any condition that would respond favorably to an increased circulation. Further studies are needed, and these should be conducted with the same careful measurements of skin temperature and rate of blood flow which Dr. Adson and his associates have used in The Mayo Clinic.

The question arises, "How vital a rôle does the sympathetic system play and are we ever justified in tampering with it?" Dr. Cannon and his students have answered this question by completely removing the sympathetic chain on both sides, from the highest cervical to the lowest sacral ganglion. Such completely sympathectomized cats have lived under laboratory conditions for many months. Doubtless such animals would succumb in the struggle for existence in the open where they had to fight for a living and adapt themselves to wide variations in temperature. But in the favorable conditions of the laboratory they lived an apparently normal existence. Everything indicates that almost any part of the sympathetic system can be removed without seriously endangering life.

CHONDROSARCOMA OF BONE[1]

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THIS study is limited to a consideration of a certain group of bone tumors containing cartilage with a view to having them recognized as a separate class. In the existing classification of the Registry of Bone Sarcoma of the American College of Surgeons, four types of lesions are recognized: one, osteogenic sarcoma with five divisions; two, periosteal fibrosarcoma; three, myeloma, which is subdivided into multiple myeloma and endothelial myeloma, or Ewing's tumor; and four, giant cell tumor undergoing malignant degeneration. There are many objections to this classification. One of the most valid is that the term osteogenic sarcoma is used too broadly at present, being indicative of all malignant tumors derived from bone or from tissue destined to form bone. It includes groups of tumors that differ as widely from each other as they do from the other classes. This is particularly true of certain sarcomata containing cartilage, and still they are thrown in the general group of osteogenic sarcomata without even being dignified as a subdivision. It is admittedly hard to classify tumors containing cartilage, but since benign cartilaginous tumors or chondromata of bone are quite generally recognized, it would seem equally feasible to recognize a class of malignant cartilaginous tumors. If tumors are classified according to tissue type, we then have the possibility of chondrosarcoma as well as chondroma developing in all bones that are preformed in cartilage. Chondrosarcomata have long been recognized as a class in the European literature and are still so recognized by many American pathologists.

Cartilage may be seen in the extracortical portions of osteogenic sarcomata which ossify by the enchondral method passing through the fibrous, cartilaginous, and osseous stages just as does the peripheral callus of a fracture in its metamorphosis from soft tissue into bone. On the other hand cartilage may comprise the bulk of the sarcoma situated either centrally or peripherally and appear as the chief end-product of tumor differentiation. Tumor bone may also be present which may be formed either by the enchondral method or by both enchondral and fibrous methods. When this is the case the term chondro-osteosarcoma has been used by Ribbert, and, when myxomatous tissue is present, myxochondro-osteosarcoma. It is extremely difficult to know in such cases whether or not part or all of the tumor comes from chondrogenic tissue. Regardless of this fact it is better in general to designate sarcomata consisting largely of cartilage as chondrosarcomata and those containing tumor bone with cartilage either absent or present only in small amounts in the regions of ossification as osteogenic sarcomata. A central sarcoma containing cartilage is more suggestive of chondrosarcoma than a peripheral one because proliferating bone of central origin as the endosteal callus of a fracture does not have cartilage appear in the process of ossification while that of peripheral origin has it as a rule.

Chondrosarcomata present sufficiently distinct morphological, clinical, and roentgenological characteristics to warrant their designation as a separate entity. They consist largely of islands of hyaline cartilage which, in the growing regions may shade over into round cell precartilage showing karyokinetic figures, hyperchromatic nuclei and other microscopic evidences of malignancy. However, in many cases the cartilage is of a mature type and the microscopic evidences of malignancy are either scanty or absent. Older portions of the tumor often calcify and ossify. The calcification and ossification frequently occur in islands and branching clumps irregularly distributed throughout the tumor. They produce irregular blotchy shadows in roentgenograms, which are quite characteristic for chondrosarcoma, making it often possible to recognize the condition pre-operatively. On the whole, chondrosarcomata grow more rapidly than osteogenic sarcomata and give rise to metastases at a later date. From the cases herein

[1]Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

Fig. 1. Central chondrosarcoma with blotchy areas of increased density in upper portion from calcification and ossification. No peripheral new bone formation except at lower part of tumor.

Fig. 2. Photograph of specimen shown in Figure 1.

reported it would seem that the prognosis is somewhat better than that of osteogenic sarcoma. Ernst, Simon, and Schmaus-Herxheimer have claimed that chondrosarcomata possess a special tendency to invade the veins, resulting in a thrombus which may extend for a great distance and even reach the heart. There is one such case to be reported in this group. The metastases in other organs are also cartilaginous and become partly ossified or calcified. Some of the chondrosarcomata arise from chondromata and cartilaginous exostoses of bone. However, sarcomata originating in a cartilaginous exostosis may take on another form, as fibrosarcoma or myxosarcoma.

In a series of 61 bone sarcomata which I have studied pathologically in the laboratories of the surgical clinics of the University of Chicago, there have been 10 cases that have been classified as chondrosarcoma. They were distributed as follows: femur, 3; humerus, 2; tibia, 2; maxilla, 1; spine, 1; rib, 1. In studying the cases of the registry it has not been uncommon to find histological and roentgenological evidence of cartilage in tumors listed under the heading of osteogenic sarcoma and a review of the material, even in the absence of the gross specimen, shows that some of them belong in the group of chondrosarcomata.

Chondrosarcomata of long bones may arise either centrally or peripherally. They are nearly always located in the ends of the shaft beginning some distance away from the epiphyseal line. Central chondrosarcomata erode the cancellous bone and cortex within, producing an expansile swelling of the shaft. In some cases this is unaccompanied by new bone formation on the periosteal surface, while in others there is marked periosteal new bone formation leading to a thick shell about the central tumor which casts a characteristic shadow in the X-ray. The following is a case of central chondrosarcoma eroding the shaft without stimulating new bone formation:

J. A., Bone Sarcoma Registry No. 812; surgeon, Dr. Gatewood. Male, colored, aged 29, entered the

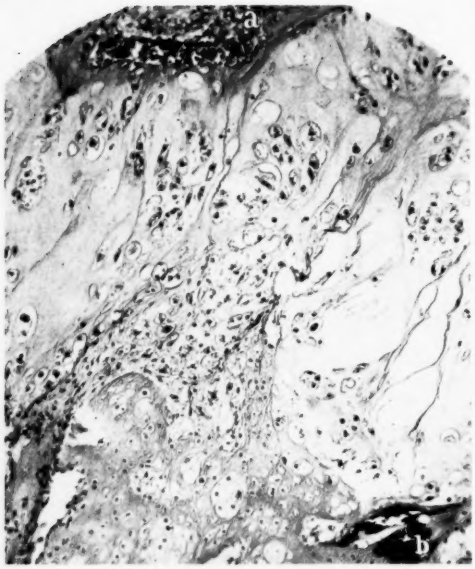

Fig. 3. Section of cartilage from interior of Figure 2. *a*, Growing zone; *b*, calcified cartilage.

Presbyterian Hospital March 7, 1926. One and a half years previously he injured the left shoulder while wrestling, following which there was slight limitation in motion but no pain. About a year later he again injured it by throwing, since which time he has had pain in the shoulder at times, and swelling has gradually developed in the region of the upper end of the humerus. It has grown rapidly in the last 4 months and there has been increase in pain and disability. There has been no loss in weight and the patient's health has otherwise been good. Examination reveals a well developed, colored male with negative findings except in the region of the left shoulder. There is a marked swelling of the upper half of the humerus which is firm and free from tenderness. There is moderate limitation of motion in the shoulder. Roentgenograms (Fig. 1) of the left humerus show a large heart shaped swelling of the upper half of the bone with the base at the shoulder joint. Bony cortex has been completely eroded in this region, the erosion ending excentrically downward in the shaft. Scattered irregularly throughout the upper part of this large soft parts shadow which replaces the bone are blotchy areas of increased density indicative of zones of calcification or ossification. X-rays of the chest were negative for metastases. Diagnosis: chondrosarcoma of the humerus based on the irregularly distributed areas of increased density seen in the X-ray. A chest girdle amputation of the extremity was performed. Dissection of the specimen (Fig. 2) revealed a heart-shaped tumor of the upper half of the humerus which had completely

Fig. 4. Central chondrosarcoma with thick shell of new bone surrounding it.

replaced the bone. It was apparently limited by the expanded rests of periosteum. It measured 8½ inches in length and 4½ inches at its greatest diameter. The surface of the tumor was somewhat nodular on longitudinal section. It was found to be bluish in color in most places looking like hyaline cartilage. Scattered throughout the bluish cartilage were irregular yellowish to dark hard areas of calcification and ossification. These were most marked in the upper portion of the tumor. There was extensive necrosis in the central region with the formation of a cavity. The neighboring periosteum and endosteum showed no evidences of reactive new bone formation and there was but slight evidence of calcification or ossification in the peripheral portions of the tumor. Microscopic examination revealed a tumor made up very largely of hyaline cartilage (Fig. 3). The cells varied greatly in size. The matrix was hyaline and in places showed signs of degeneration. In the deeper portions of the tumor there were a few small areas of calcified cartilage and trabeculæ of bone of immature type. There were layers

Fig. 5. Coronal section of specimen shown in Figure 4 with hyaline cartilage interior.

of round cell precartilage about the periphery of the tumor in certain regions showing evidence of marked tumor growth. Very few karyokinetic figures or heavily staining nuclei were to be seen. Diagnosis: chondrosarcoma. Three and one half years after amputation the patient was alive and well.

There are two cases of chondrosarcoma of the upper end of the femur which began centrally and stimulated marked surrounding new bone formation. They eventually broke through the cortex to form a tumor about the periphery of the bone.

L. B., Bone Sarcoma Registry No. 1025; surgeon, Dr. Kellogg Speed. Male, aged 41 years, entered the Presbyterian Hospital October 2, 1921. He had pain in the upper end of the left thigh for about one year and for 4 months had had a swelling of the upper end of the left femur most marked over the dorsum. There had been no loss in weight and his general health had not been affected. Examination

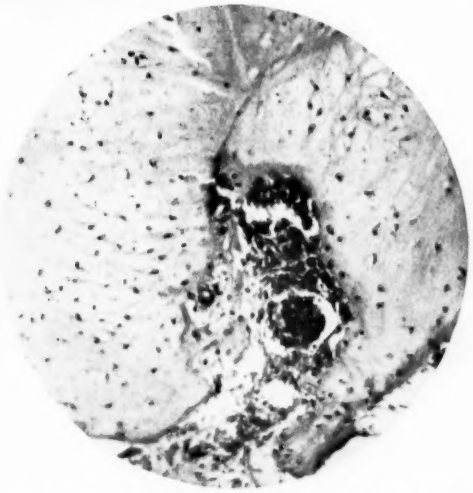

Fig. 6. Histological appearance of centrally situated cartilage shown in Figure 5.

revealed a well developed colored male. Physical examination was negative aside from the region of the left thigh. There was a moderate sized swelling of the upper third of the shaft of the femur which was most marked on the posterior side. It was firm and not tender; there was slight limitation in motion of the hip. A roentgenogram (Fig. 4) revealed a centrally situated oblong area of reduced density of the upper end of the femur extending downward from the base of the neck for a distance of 10 centimeters. The cortex about it was expanded into a spindle shaped swelling and was markedly thickened. The shaft was also slightly expanded and showed an increase in density for a distance of 4 centimeters below the limits of central destructive area. A diagnosis was made of sarcoma of the femur and the hip joint was disarticulated. Dissection of the specimen revealed a spindle shaped swelling of the upper 6 inches of the shaft of the femur which was most marked in its posterior and superior portions. The swelling was bony and hard anteriorly, but posteriorly there was an egg-sized area of soft semi-fluctuant tissue. When this was cut into it was found to consist of bluish hyaline cartilage with extensive mucoid degeneration in its central portion. Longitudinal section of the bone revealed a large ovoid mass of bluish soft cartilage filling the slightly expanded medullary cavity of the upper 10 centimeters of the shaft (Fig. 5). The cortex was perforated posteriorly, where the hyaline cartilage tissues on the inside and outside of the bone were in communication. The surrounding cortex showed marked thickening varying in width from 0.8 to 2 centimeters. There was also marked bony thickening of the shaft for 4 centimeters below the cartilaginous tumor. Microscopic examination showed

Fig. 7. Central chondrosarcoma with shell of new bone about it.

the central tumor to be composed of hyaline cartilage which was somewhat lobulated and contained numerous blood vessels in the interlobular septa (Fig. 6). There was actively growing cartilage along the septa of the lobules. The cartilage of the external swelling revealed extensive mucoid degeneration. A section of the bony wall showed markedly irregular new bone formation. There was no evidence of tumor invasion except about the inner limits where cartilage cells are eroding and in places penetrating the vascular spaces of the bone. There were a few small islands of calcification and ossification within the central cartilaginous tumor but none in the tumor outside of the bone. From the rapidity of growth and the gross and microscopic features of the tumor, a diagnosis of chondrosarcoma was made. The patient is alive and well now, 9 years after operation.

A second case is similar but more malignant and came under observation when the disease was in a much more advanced stage.

S. G., Bone Sarcoma Registry No. 1026; male, age 55, entered the University of Chicago Clinics December 20, 1928. He gave a history of pain in the upper part of the left thigh beginning one and a half years before. He was treated for sciatica for several

Fig. 8. Coronal section of specimen shown in Figure 7. Central tumor largely cartilaginous. Bone extensively infiltrated with tumor. Lateral peripheral tumor cartilaginous and markedly degenerated.

months, but the pain increased in severity and he lost in weight and strength. Four months ago he noticed a swelling of the upper part of the left thigh which rapidly increased in size up to the time of admission. He received deep X-ray therapy 1 month before admission and had a burn of the skin over the lateral surface. His weight dropped from 225 to 145 pounds in the previous 15 months. Examination revealed a somewhat emaciated elderly man. Regional examination was negative aside from the left thigh where there was a large, firm tumor encircling the bone, but greatest on the lateral and posterior sides. X-ray examination of the lungs was negative for metastases. A roentgenogram (Fig. 7) revealed an oblong central area of irregularly reduced density in the upper 13 centimeters of the

Fig. 9. Junction of central tumor of hyaline cartilage, *a*, and bony shell infiltrated by round cell tumor, *b*.

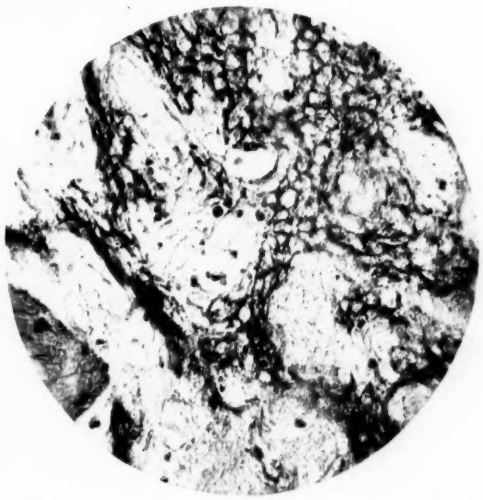

Fig. 10. Ossified tumor infiltrating cancellous bone of head of tumor.

shaft of the femur. The shadow of the cortex about it is markedly expanded and increased in density and there is thickening of the shadow of the cortex of the shaft below for a distance of 7 centimeters. There is an oval soft parts shadow about the femur at this level, but there are no evidences of calcification or ossification in it. Profiting from the study of the previous case a diagnosis of central chondrosarcoma was made. A hip joint disarticulation was performed. Dissection of the thigh revealed a large, soft, irregularly spherical swelling encircling the upper 6 inches of the shaft of the femur except on its mesial side. In some places fluctuation could be made out. The shaft of the bone was slightly thickened for a distance of 5 centimeters below the soft parts tumor. Longitudinal section of the bone (Fig. 8) reveals a sharply circumscribed oval area measuring 12 centimeters in length by 4 centimeters in its greatest diameter occupying the interior of the upper part of the shaft. It is filled largely with bluish cartilage, throughout which are scattered yellowish to brown areas of bony density. The bony cortex about this cartilaginous mass is expanded, thickened, and invaded by tumor. The cortex below is markedly thickened for a distance of 10 centimeters, the thickening tapering off from above downward. The medullary cavity below is filled with new bone for a distance of 5 centimeters. The entire head and neck and most of the greater trochanter above the limits of the central cartilaginous tumor are infiltrated with spongy tumor bone. The large, spherical swelling located about the periphery of the shaft is composed of bluish hyaline cartilage which has undergone extensive degeneration in its central portion where there are irregular cavities filled with a mucoid material. Sections were taken from the central and peripheral cartilaginous portions, from the sclerosed shell, and from the sclerosed bone above and below. Sections of the interior portion consist largely of atypical immature hyaline cartilage which is arranged in large whorls and in places is broken down. It shades over gradually into a round celled tissue which is present in islands within the cartilaginous substance and which invades the bony shell at the periphery (Fig. 9). The irregularly dense islands within the central cartilage are composed of calcified cartilage and of immature cancellous tumor bone. Karyokinesis and hyperchromatosis can be seen in the round cell tissue. Sections of the bony shell reveal a dense bone which is very extensively infiltrated with round cell tumor, there being very little cartilage found. The sections of the thickened bone below and of the head show infiltration with round cell tumor which has undergone extensive ossification forming a very immature type of tumor bone (Fig. 10). Sections of the large peripheral tumor show it to be composed of hyaline cartilage which in places about the periphery is richly cellular and actively growing. In other places it shades over into fibrous tissue and in its deeper portions it has undergone extensive degeneration. There are cavities filled with mucoid débris. Diagnosis: central chondrosarcoma, with marked reactive hyperplasia of the surrounding bone, ossification of the tumor infiltrating bone, and mucoid degeneration of the peripheral tumor. The patient made an uneventful recovery from the operation. Six weeks later he began to have headaches which were followed in 2 weeks by paralysis of the right side of the body. A diagnosis of cerebral metastases

Fig. 11. Sharply circumscribed erosive lesion of interior with dense specks at central portion. Thickening of mesial portion of the shell and cortex of shaft.

was made, and death followed 3 months after the operation. An autopsy was not performed.

The central eroding portion of this tumor and the large external mass remained largely cartilaginous, but much of the round cell portion infiltrating the bone ossified without the appearance of cartilage in the process. Because of the mixed character of the tissue it might be designated by some as a chondro-osteosarcoma, and by others as an osteogenic sarcoma with bone formation by the enchondral method. Since the oldest part and by far the greater part of it remained cartilaginous it would seem more appropriate to call the tumor a chondrosarcoma.

A third case of chondrosarcoma of the upper end of the shaft of the femur has recently come to our attention. In this case the growth produced central cortical erosion and very little peripheral cortical proliferation of bone at the level of the lesion. However, there was considerable proliferation along the course of the shaft below.

E. K., female, aged 39 years, entered the University of Chicago Clinics with a history that for 6

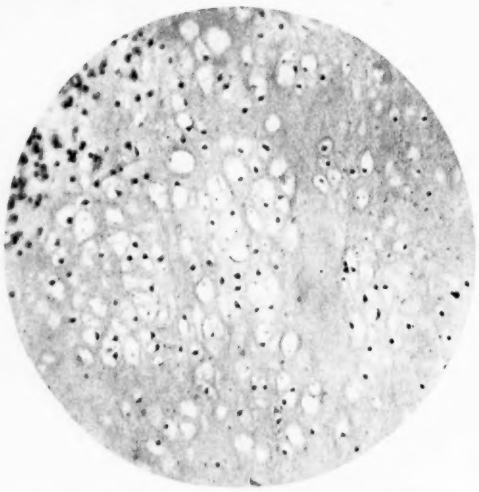

Fig. 12. Mature hyaline cartilage from central portion of tumor.

years she had had pain of varying intensity in the sole of the foot and outer side of the leg and thigh. It had been more severe in the hip for 2 weeks. As a result of slight violence it suddenly became worse and she was unable to walk. A roentgenogram taken immediately showed a sharply circumscribed central destructive lesion of the upper end of the femur extending upward into the trochanters and base of the neck (Fig. 11). The surrounding cortical shell was thickened mesially and there was a transverse fracture line at the middle of its thin lateral portion. The shaft below presented evidence of periosteal thickening on the mesial side extending downward for 5 centimeters and was more dense in the endosteal region for a distance of 2 centimeters below the eroding area. At the center of the area of reduced density there were a few dense specks suggestive of calcified or ossified areas. These, along with the periosteal thickening of the shaft aroused suspicions of a central chondrosarcoma. The patient showed no general evidence of malignancy and roentgenograms of the chest were negative. Benign giant cell tumor was also considered, but this is an unusual location for such tumors. Bone cyst was also thought of, but a solitary cyst beginning in adult life is a rare occurrence.

At operation a thin layer of grayish soft tumor was found breaking through the cortex laterally. A window of cortex 3 inches long was excised. The bone was found to be eroded and infiltrated with tumor. The large central cavity was filled with soft tumor which was bluish gray in its peripheral portion, but beneath the surface it consisted of a firm bluish hyaline cartilage which in places contained islands of calcification and ossification. The tumor was curetted out as thoroughly as possible. The

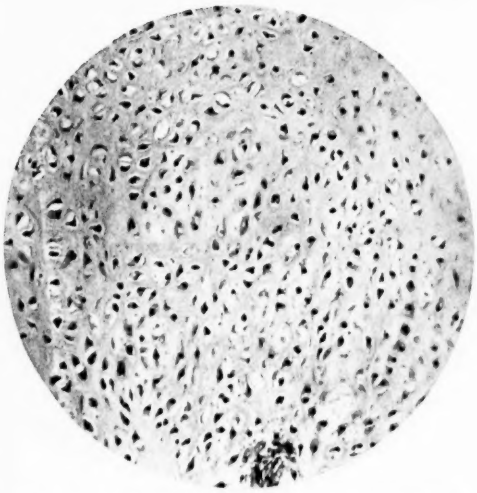

Fig. 13. Photomicrograph of section from periphery of central tumor showing richly cellular hyaline cartilage formation.

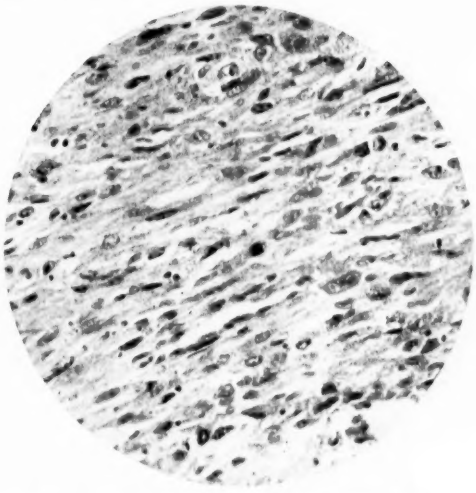

Fig. 14. Round and spindle-cell tumor about the periosteal surface of the bone and infiltrating remnants of cortex.

cavity was swabbed with 95 per cent carbolic followed by alcohol and was allowed to fill with blood. The soft parts were closed and a cast applied. Microscopic examination of the excised tissue showed the great mass of the central tumor to consist of mature hyaline cartilage (Fig. 12). The amount of calcification in it was small but it contained a moderate amount of spongy tumor bone, the cancellous spaces of which were filled with a sparsely cellular fibrous marrow. Sections of the tissue about the periphery showed a richly cellular hyaline cartilage (Fig. 13). Sections of the bony cortex showed it to be infiltrated and eroded by a richly cellular round and spindle cell tumor which contained many mitotic figures. The grayish tumor along the periosteal surface presented the same histologic appearance (Fig. 14). A Mallory stain showed almost complete absence of collagen in this growing portion of the tumor. Diagnosis: chondrosarcoma consisting very largely of hyaline cartilage, but with a precartilaginous proliferating zone about the periphery and calcified and ossified nodules in the older portions of the lesion. The long duration of symptoms and the absence of evidences of metastases were indications of a relatively benign tumor. Roentgen-ray treatments have been started.

The following is a case of chondrosarcoma of the greater tubercle and surgical neck of the humerus which stimulated marked new bone formation on the central side of the lesion.

C. S., Bone Sarcoma Registry No. 1031; male, aged 22 years, entered the Presbyterian Hospital, August 1, 1919. Three and a half years before admission he began to have slight pains in the region of the right shoulder. This was followed by slight limitation of motion. Recurring pains and stiffness continued up to 2 years ago, when an area of reduced density in the region of the greater trochanter was curetted elsewhere. The symptoms recurred and one year ago a second curettage was performed. The nature of the curettings was not learned. The stiffness continued and the pain soon returned. Of late the pain and stiffness have been more marked than ever. He was otherwise in good health. Physical examination revealed a well developed young man with essentially negative findings aside from the region of the right shoulder. There was a scar over the anterolateral aspect of the deltoid and a slight swelling in the region of the greater trochanter which, on palpation, was hard, but not tender. There was marked limitation of motion in the shoulder joint. A roentgenogram of the shoulder (Fig. 15) revealed irregular reduction in density in the region of the greater tubercle and lateral portion of the surgical neck, with slight peripheral enlargement. There was marked increase in density of the neck and shaft mesial to and below the region of the tubercle, the density gradually diminishing from above downward for a distance of 2 inches. There was irregularity of the articular surfaces of the shoulder joint indicative of a chronic arthritis. Because of the recurrences after curettage with peripheral extension of the tumor, the marked sclerosis of the surrounding bone and the marked increase in pain, a diagnosis of sarcoma of the humerus was made, type undetermined. The upper 6 inches of the humerus including the periosteum was resected, care being taken to go wide of the bone at its upper end. A bone

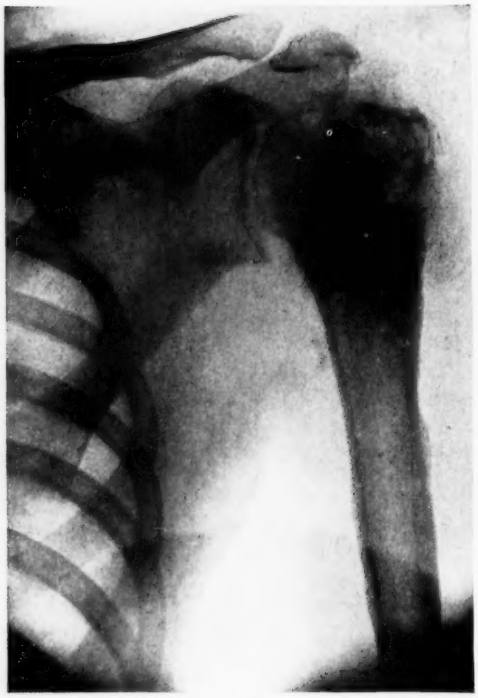

Fig. 15. Chondrosarcoma destroying lateral portion of upper end of humerus and stimulating marked ossification in the adjacent bone.

graft from the tibia was inserted into the defect and the patient had an uneventful convalescence. Examination of the specimen revealed a slight bony swelling in the region of the greater tubercle and extending downward for a distance of 1.5 centimeters on the shaft. It was soft in places where cortex had been completely eroded. The articular cartilage was thinned and irregular as a result of chronic arthritis. Coronal section of the bone (Fig. 16) revealed a soft tumor mass of mottled brown, blue, and gray color occupying the region of the greater trochanter and lateral portion of the surgical neck. There was dense bone in the neck and upper portion of the shaft mesial to and below, which extended downward for a distance of 2 inches. Bony cortex was increased in density along the lower border of the tumor, but was absent over its upper portions. The periosteum appeared to be intact in the regions where cortex was completely destroyed. A roentgenogram of a slice, two-thirds of a centimeter in thickness (Fig. 17) shows the density in greater detail. There are numerous irregular areas of increased density scattered throughout the tumor of the greater tubercle. Microscopic examination of the soft tumor showed it to be made up of richly cellular hyaline cartilage

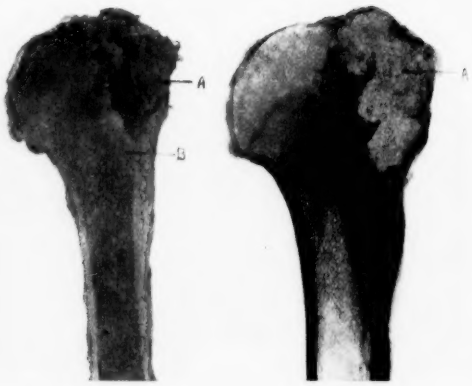

Fig. 16 (left). Coronal section showing cartilaginous tumor, *a*, and the adjacent osteosclerosis, *b*.

Fig. 17. Roentgenogram of slice of specimen shown in Figure 16. Islands of increased density in cartilaginous tumor, *a*.

with scattered small areas of calcification and a small amount of ossification (Fig. 18). A few of the cartilage cells showed heavily staining nuclei, and there were very few karyokinetic figures to be seen in the section. Sections of the surrounding bone showed it to be markedly eburnated, but there were no signs of tumor within its substance. There was evidence of bony erosion at the junction of tumor and bone where lacunar absorption was taking place. Examination of the synovial lining showed fibrous hyperplasia and some lymphocytic infiltration, but no signs of tumor. The diagnosis was made of chondrosarcoma of slow growth, probably originating in a chondroma. The patient has since remained free from evidences of recurrence and Figure 19 shows a roentgenogram of the shoulder taken 8 years later. There was some new bone formation along the side of the scapula probably derived from periosteum which was taken off in detaching the muscles from the humerus.

Chondrosarcomata of the short or flat bones of the trunk usually begin centrally and break through the cortex forming an external tumor mass without stimulating thick shell formation. The following case of chondrosarcoma of the superior maxilla ran a fatal course with the development of metastases and with extremely little calcification or ossification in it.

J. C., Bone Sarcoma Registry No. 1027; female, aged 35 years, had a painful swelling of the left superior maxilla of 1 year's duration. A firm mass about the size of an egg occupied the region of the antrum and bulged laterally above the gum margin. It was excised and found to consist of cartilaginous

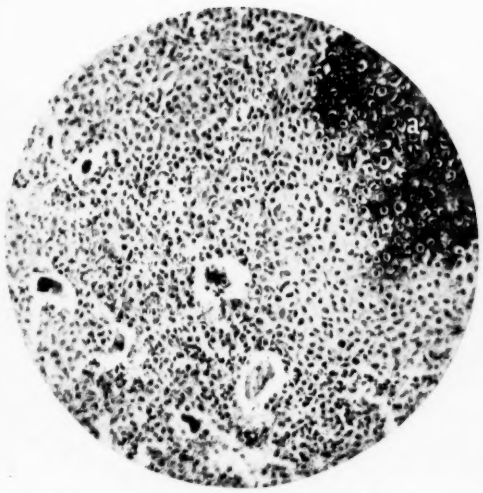

Fig. 18. Histological section of tumor shown in Figure 16, with island of calcified cartilage, *a*, and giant cells scattered throughout the hyaline cartilage.

tumor. The submaxillary and deep lymph glands were also excised on the affected side. The patient returned 16 months later with a recurrence considerably larger than the original tumor. At operation the greater portion of the mass was removed, but it extended posteriorly into the nasopharynx and superiorly, bordering on the orbit, in which regions tumor tissue was left behind. Pathological examination of the excised specimen showed several nodules of bluish cartilaginous tissue, the largest measuring 2 by 3 centimeters. The tumor was soft and broken down in places. Small pieces of bone were attached to the deeper portions of the lesion. Microscopic examination showed it to consist of hyaline cartilage arranged in lobules about the growing periphery where it shaded over into round cell precartilage (Fig. 20). In this region there were occasional karyokinetic figures and hyperchromatosis. There was a small amount of calcification in the deeper portions of the tumor and a few small, pea-sized nodules of osteoid tissue were present. There was recurrence of the tumor following the second operation with the development of a large infected mass which extended backward into the nasopharynx and into the opposite side of the nose. Diagnosis was chondrosarcoma of the maxilla with slight tendency to calcification and ossification. The patient gradually lost in weight and strength and died of the tumor 1½ years later. No autopsy was obtained. In this case the tumor consisted almost entirely of somewhat lobulated hyaline cartilage which showed marked proliferative tendencies at the periphery where the usual microscopic characteristics of malignancy could be made out.

Fig. 19. Result 8 years after excision of tumor shown in Figure 15 with replacement of bone transplant.

In the following case of chondrosarcoma of the rib there was a marked tendency to calcification and to a lesser amount of ossification.

L. C., Bone Sarcoma Registry No. 1030; male, aged 20 years, had a tumor of the right side of the chest centering about the anterior end of the right fourth rib which had been gradually increasing in size for 2 years. It produced slight pain but there had been no loss in strength or weight. Examination showed a well developed young male. There was a large firm tumor approximately 15 centimeters in diameter protruding from the chest wall and overlapping the second to the seventh ribs. There were no signs of metastases. Operation by Dr. A. D. Bevan revealed a tumor which consisted of cartilage and so involved the chest wall that only the large external mass was removed. The specimen consisted of a mass of cartilage in the shape of a segment of a sphere measuring 12 by 10 by 4 centimeters in its greatest dimensions. The convex periphery was

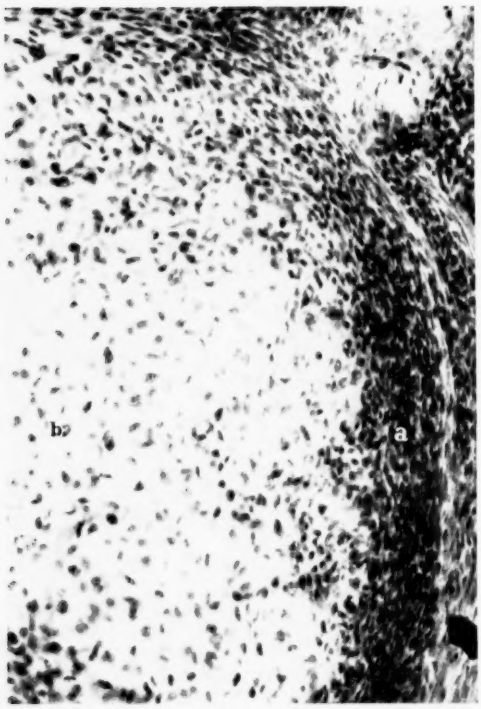

Fig. 20. Histological appearance of nodule of chondrosarcoma of maxilla showing zone of cartilage growth, *d*, and maturer hyaline cartilage, *b*.

smooth and had a fibrous covering. The cut and broken surfaces were irregular. The peripheral portion of the mass consisted almost entirely of bluish hyaline cartilage, but the deeper portion (Fig. 21) contained irregularly scattered islands of yellowish to dark brown dense areas of calcified cartilage and bone. Figure 22 is an X-ray of one-half of the specimen showing the blotchy distribution of the calcified and ossified areas. Microscopic examination showed the tumor to consist very largely of a heavily staining hyaline cartilage. In its growing peripheral portions it was thrown into folds and shaded over into richly cellular round cell tissue. In its deeper portions there were irregular islands of calcification and immature tumor bone (Fig. 23). Very few deeply staining nuclei and no dividing nuclei could be seen. Diagnosis: chondrosarcoma of the rib with calcification and ossification. The remaining mass of tumor rapidly increased in size and the patient lost in weight and strength. Metastases developed in the lungs and death occurred 9 months after operation. In this case the diagnosis of sarcoma was difficult to establish by microscopic examination, the picture being more that of a calcifying and ossifying chondroma. The subsequent course of events, however, proved that the lesion was a sarcoma.

D. C., Bone Sarcoma Reigstry No. 1032; male, aged 46 years, previously reported by Bassoe, was admitted to the Presbyterian Hospital, February 7, 1916. He complained of pain in the right arm for 20 months and the right side of the neck of 5 months' duration. It had gradually increased in severity and for 2 weeks there had been weakness in the right arm and leg. For 2 days there had been weakness in the left arm and leg. Physical examination revealed a small hard mass on the posterior and lateral aspects of the fifth and sixth cervical vertebræ. There was marked weakness in the right arm and leg and slight weakness in the left arm and leg. All forms of sensation were markedly impaired below the level of the sixth cervical segment, the impairment being more marked on the right than on the left side. A roentgenogram (Fig. 24) revealed slight reduction in height of the body of the sixth cervical vertebra with slight irregularity in its density. The right transverse process of the sixth vertebra had been destroyed and there was a dense irregular shadow occupying a part of the region extending upward toward the fifth vertebra. There were other isolated and branching areas of increase in density extending laterally and downward from it opposite the right transverse process of the sixth cervical vertebra. Operation (Dr. Bevan) revealed a large cartilaginous tumor in the region of the right side of the arch and transverse process of the sixth cervical spine. It extended forward into the body. The tumor was partially removed. It consisted of several particles of tissue, bluish in color, and containing a few areas of bone and yellowish calcified cartilage. Microscopic examination showed the sections to consist largely of hyaline cartilage. About the periphery of the tumor the cartilage was lobulated and shaded over into round cell precartilage. In the deeper portions the cartilage was more mature and was calcified in areas (Fig. 25). There were spicules of bone blood vessels in these areas, where the calcified zones had been partly replaced by bone.

The tumor mass in the neck gradually increased in size. The patient developed complete paralysis from compression of the cord and died 5 months after operation. No autopsy.

PERIPHERAL CHONDROSARCOMATA

Chondrosarcomata arising peripherally or breaking through the cortex early, with the development of a large peripheral lesion, are likely to possess islands and branching areas of calcification and ossification which produce a characteristic picture in the X-ray. They may also invade the medullary cavity of the bone, but the characteristic bony proliferation with the formation of a shell, which was seen in the central chondrosarcomata, is absent.

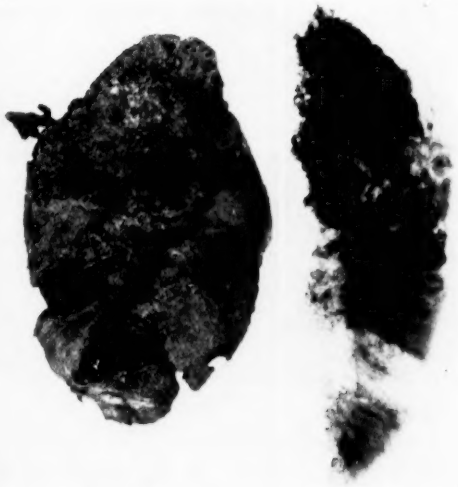

Fig. 21 (left). Cut surface of chondrosarcoma of rib showing calcified and ossified nodules.

Fig. 22. Roentgenogram of portion of specimen shown in Figure 21, showing character of shadows in less calcified and ossified lower end.

The following case is an example of this type:

J. L., Bone Sarcoma Registry No. 1028; male, aged 14 years, entered the University of Chicago Clinics because of a large swelling of the upper portion of the right leg which had developed gradually during the previous 9 months. The swelling was noticed soon after a blow over the upper end of the tibia. For 6 months there had been increasing pain and for 2 months there had been loss of weight and strength. Two months before admission the mass had been incised anteriorly, since which time there had been an outgrowth of fleshy granulations through the incision. Examination revealed a somewhat emaciated, anæmic, young male. There was a large oval tumor mass involving the upper half of the right tibia, with a central fungating area at the point of incision. No inguinal gland metastases. Physical examination was otherwise negative. A roentgenogram of the chest revealed no metastases.

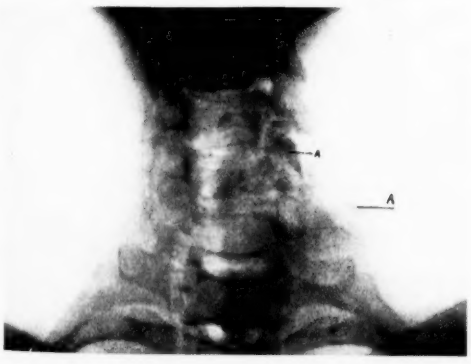

Fig. 24. Chondrosarcoma of cervical spine with blotchy shadows, *a*, produced by islands of calcification and ossification.

Fig. 23. High power view of tumor shown in Figure 21 with heavily staining hyaline cartilage, *a*, and osteoid tissue, *b*.

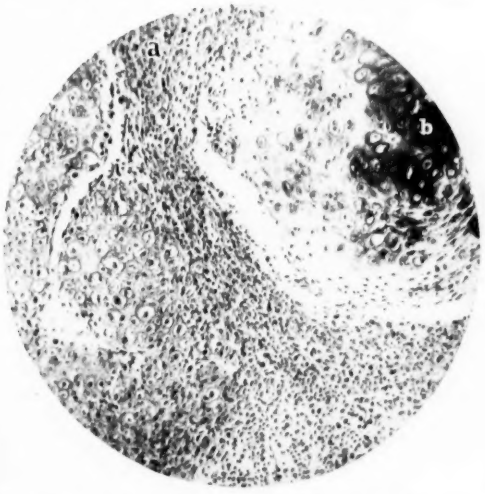

Fig. 25. Section of tumor shown in Figure 24 with zones of proliferating hyaline cartilage, *a*, and with areas of calcification, *b*.

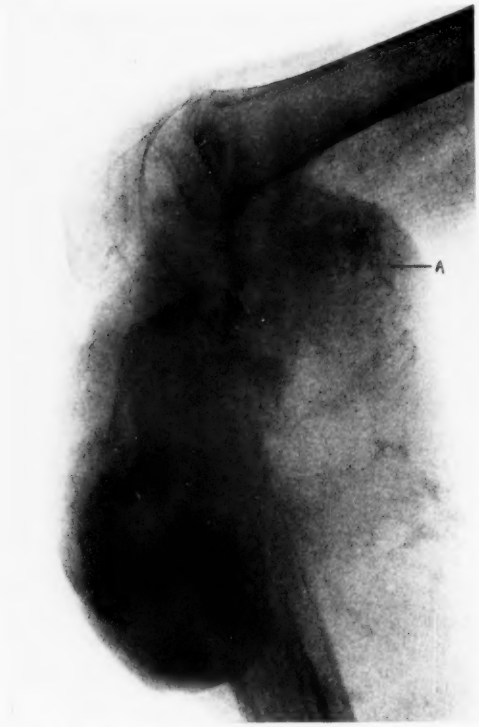

Fig. 26. Tumor of upper end of tibia with dense islands, *a*, in peripheral portion characteristic of chondrosarcoma.

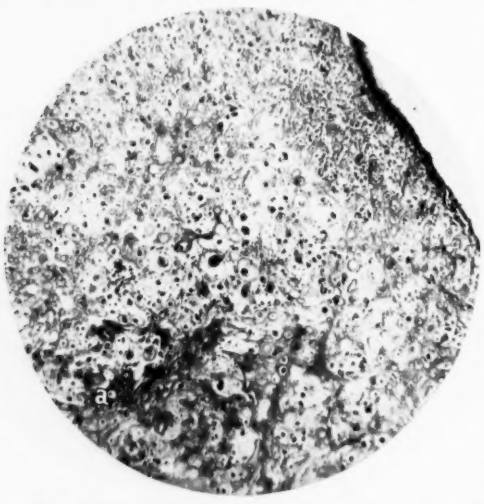

Fig. 28. Tumor thrombus shown in Figure 27 composed of hyaline cartilage with islands of calcification, *a*.

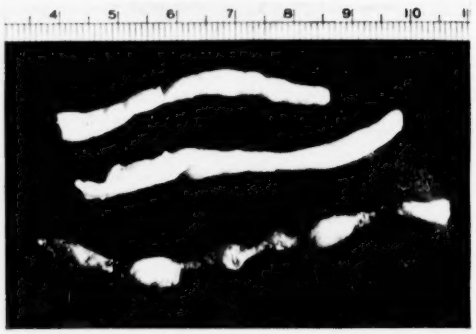

Fig. 27. Segments of thrombus consisting of cartilaginous tumor removed from femoral vein.

A roentgenogram (Fig. 26) revealed a large oval peripheral swelling of the upper 7 inches of the right tibia with extensive irregular reduction in density of the cortex of the metaphysis. The greater portion of the external shadow was posterior to the tibia extending upward into the popliteal space. It contained irregular islands and strands of increased density. The oval shaped area anterior to the tibia was of uniform density and contained no shadows suggestive of calcification or ossification. Roentgenogram of the lungs showed no evidence of metastases. A mid-thigh amputation was performed with a constrictor applied over a transfixion pin at the level of the greater trochanter. When the femoral vein was cut through, it was found to contain a tumor thrombus extending in both directions. Traction on the tumor mass in the upper end dislodged a bluish white thrombus measuring 11 centimeters in length. Traction on the lower tissue dislodged a thrombus 7 centimeters in length, which consisted partly of bluish white tumor and partly of clotted blood (Fig. 27). Microscopic examination of the tumor thrombus (Fig. 28) showed it to consist of hyaline cartilage which was richly cellular in its peripheral portion and which contained scattered islands of calcification in its deeper portion. It contained no bone. Dissection of the limb uncovered an irregularly spherical, firm, soft swelling of the upper 16 centimeters of the tibia. Its surface was somewhat nodular but sharply circumscribed. There was a fungating surface 3 by 4 centimeters anteriorly. On longitudinal section (Fig. 29) the tumor was found to infiltrate both epiphysis and shaft at that level. The posterior part of the tumor was bluish gray in color. The portion of tumor within the bone consisted largely of spongy bone, and calcified and ossified islands were irregularly distributed in the posterior portion of the peripheral tumor. Roentgenogram of a slice 1.5 centimeters thick from the middle of the tumor (Fig. 30) revealed irregular reduction in density of the shadow of the old shaft and islands and irregular strands of increased density in the soft parts shadow of the peripheral

Fig. 29. Longitudinal section of tumor shown in Figure 26.

Fig. 30. Roentgenogram of slice from middle of tumor shown in Figure 29.

tumor in its posterior portion. Microscopic sections were made from different portions of the tumor. The unossified portions were found to consist largely of hyaline cartilage with extensive areas of degeneration which shaded over in places into fibrocartilage and connective tissue (Fig. 31). Its dense areas consisted of calcified cartilage which in places had been replaced by immature bone.

This tumor appears to have arisen within the bone about the periphery of the posterior part of the upper end of the tibia making a large external swelling and infiltrating the bone and secondarily invading the bone at this level. It had invaded the femoral vein producing a tumor thrombus which extended to the upper limits of the thigh. The main body of the tumor was cartilaginous shading over into fibrous tissue or fibrocartilage on the one side and calcified cartilage and bone on the other. The tissue invading the vein consisted entirely of cartilage. In view of these facts the tumor should be regarded as a chondrosarcoma. The convalescence was uneventful. Nine months later the boy appeared in excellent health and had gained considerably in weight and strength. However, a roentgenogram of the chest reveals a circular shadow in the lung about 1.5 centimeters in diameter, which has been interpreted as due to a metastasis.

It is not uncommon to find tumors listed in the Registry as osteogenic sarcomata which present large peripheral swellings and roentgenologically show blotchy dense areas which are peripherally located and disconnected from the main shadow of the bone. The gross description usually relates the presence of cartilage in them and examination of the microscopic slides shows a large amount of hyaline cartilage with partial calcification and ossification. A review of these cases would undoubtedly show that some of them belong to the group of chondrosarcomata according to the criteria herein given for that condition.

The condition known as multiple cartilaginous exostoses, beginning in childhood and resulting in multiple cartilage-capped tumors, especially of the ends of the shafts of the long

Fig. 31. Histological appearance of peripheral portion of tumor shown in Figure 29. *a*, Hyaline cartilage; *b*, fibrocartilage; *c*, calcified cartilage.

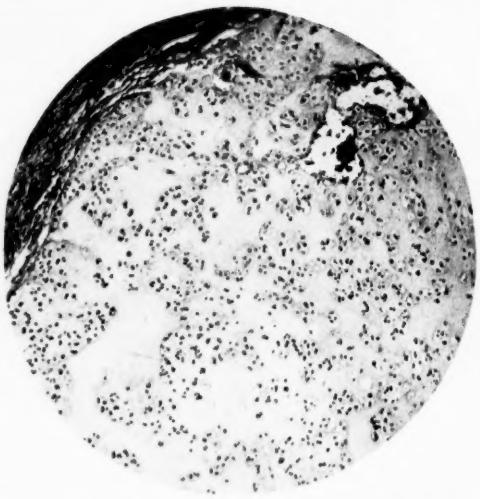

Fig. 33. Section of periphery of cartilage capping the exostosis of tibia.

bones is a fairly common disorder, and not infrequently runs in families. Sarcoma developing from one of these exostoses or in a patient with a single exostosis is comparatively rare. In the following case of multiple cartilaginous exostoses, a chondrosarcoma developed from an exostosis of the upper end of the tibia:

A. R., Bone Sarcoma Registry No. 1034; male, aged 40 years, first noticed bony protuberances on

Fig. 32. Cartilaginous exostosis of upper end of tibia with secondary invasion of fibula.

Fig. 34. Bony spurs on amputation stump with recurrence of cartilaginous tumor, *a*, over lateral spur.

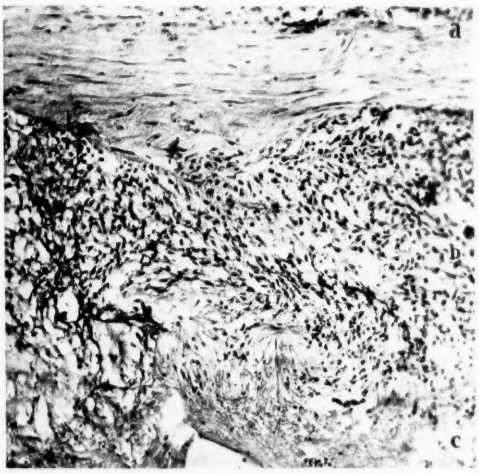

Fig. 35. Microscopic section of periphery of cartilaginous tumor shown in Figure 34. *a*, Fibrous covering of tumor; *b*, proliferating zone of cartilage and myxomatous tissue; *c*, degenerating zone bordering on cavity.

the upper ends of humeri, femora, and tibiæ, and on the pelvis, clavicles, and scapulæ, at the age of 12 to 14 years. They increased slightly in size and remained small with the exception of a lesion on the lateral aspect of the right tibia. At the age of 27 a tumor mass in this region began to increase in size and at the age of 34 the mass was about the size of a fist. A roentgenogram (Fig. 32) showed a large exostosis springing from the posterolateral surface of the upper third of the tibia. It had a broad base and a cauliflower-like periphery. The lesion was operated on and partly removed. The wound became infected and since then there was a chronic osteomyelitis with a discharging sinus. Three or four operations were then performed in an endeavor to get rid of the tumor and osteomyelitis but without success. At the age of 37 he came under my care when the upper 8 inches of the fibula and the tumor bridge extending to it from the tibia were excised. On dissection the bridge was found to be composed of spongy bone with a sinus and an osteomyelitic area at its inferior portion. It was capped both anteriorly and posteriorly by thick nodules of encapsulated cartilage extending out into the muscles. Some of the nodules were ¾ inch thick and were broken down internally where they were filled with a mucinous fluid. Microscopic examination showed the nodules to be composed of hyaline cartilage (Fig. 33). In places there was degeneration in the central regions and a cellular zone of proliferation along the periphery. No karyokinetic figures were to be seen. The bony portion was composed of cancellous trabeculæ and bone marrow. At the junction of bone and cartilage there was a zone of growth where bone was being laid down through cartilage.

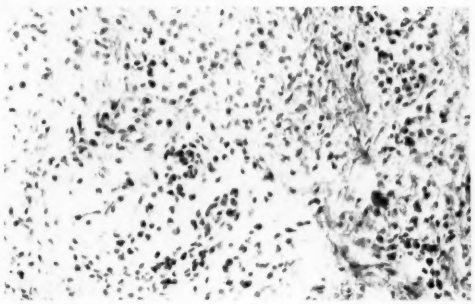

Fig. 36. Metastasis in medullary canal composed of myxomatous tissue undergoing degeneration and an embryonic type of cartilage.

There was severe infection of the operative field with extension to the knee and suppurative arthritis which necessitated disarticulation 3 weeks later. A large anterior flap of tissue which had covered the exostosis was turned back and it carried portions of the tumor which led subsequently to recurrence. Because of infection and retraction of flaps a supracondylar amputation of the femur was performed 5 weeks later. The infected stump gradually healed in 3 months, but bony spurs formed on the medial and lateral aspects of the end of the femur. These spurs remained much the same until 21 months later when a soft bluish swelling appeared over the end of the lateral one. This gradually increased in size until 2 months later it measured 2.5 centimeters in diameter and was semifluctuant (Fig. 34). At operation skin flaps were reflected and 5 centimeters of the end of the stump was removed.

Dissection of the specimen showed bony spurs on the mesial and lateral sides of the end of the stump and on coronal section there was a large bluish hemispherical cartilaginous mass projecting downward with a base 3 centimeters broad resting on the lateral aspect of the bony stump and exostosis. Its central portion was broken down and filled with a mucinous fluid. Microscopic section of the mass showed it to be composed of a round cell proliferating zone along the periphery which passed over into a layer of immature hyaline cartilage and this into a deeper layer of degenerated tissue bordering on the mucinous cavity (Fig. 35). There were a few heavily staining nuclei in the growing peripheral portion, but no cell division was seen. The spurs consisted of mature bone and sections of the end of the stump showed no tumorous infiltration of the old bone.

Within a month small spurs reformed about the sides of the end of the stump and in 12 weeks a semifluctuant tumor had reappeared directly over the end of the stump. It soon became cystic and broke through the scar, discharging a mucinous fluid. Three and a half months after the first stump amputation a re-amputation through the upper third of the thigh was performed removing 12 centimeters

Fig. 37. Roentgenogram of portion of lung containing four nodules of metastatic chondrosarcoma that were partly calcified and ossified.

of the shaft of the bone. Dissection of the stump showed broken down faint blue cartilaginous tumor covering the end of the stump and infiltrating the medullary cavity and cortex for a distance of 0.5 to 1 centimeter. On longitudinal section of the shaft, a large gray oval metastasis 1.5 by 3 centimeters was found to occupy the medullary canal 6 centimeters above the end of the stump. Microscopic examination of the tumor at the end of the stump showed it to be similar to that in the stump which had been previously amputated. Sections of the metastasis in the medullary canal 6 centimeters higher up showed (Fig. 36) a richly cellular tumor composed of myxomatous cells and hyaline cartilage cells with considerable mucoid degeneration. Karyokinetic figures were fairly abundant. A roentgenogram of the chest revealed no evidences of metastases, and there is now no sign of local recurrence 1 month after the amputation.

The local development of the soft degenerative tumor on top of the end of the stump 21 months after the original amputation and the recurrence in the stump after re-amputation as well as the histological appearance were highly suggestive evidences of malignancy, but the final evidence was the finding of a metastasis in the medullary canal of the shaft above the stump. The malignant tumor consisted of precartilaginous and myxomatous elements with a small amount of hyaline cartilage and showed practically no tendency to ossification. This was in marked contrast to the original benign tumor of the tibia consisting of mature cartilage which underwent extensive ossification. This patient has two

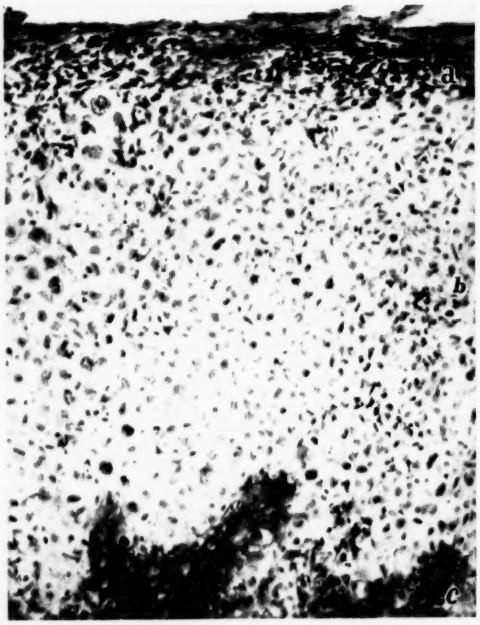

Fig. 38. Histological picture of tumor shown in Figure 37. *a*, Proliferating zone; *b*, hyaline cartilage; *c*, calcified cartilage.

sons, ages 4 and 6, who have multiple cartilaginous exostoses. There are 2 cases of this type in the registry recorded by others, abstracts of which follow:

CASE 343 of the Bone Sarcoma Registry had first a sarcoma develop in an exostosis about the right elbow at the age of 24. The right arm was amputated and the pathological report was osteochondrosarcoma. Nineteen years later a sarcoma appeared on the lower end of the left femur which necessitated a mid-thigh amputation. Microscopic examination showed a sarcoma made up largely of hyaline cartilage. It has been variously diagnosed as chondroma, myxochondroma, chondrosarcoma, and osteogenic sarcoma. The patient died 3 years after amputation, from acute appendicitis, free from evidences of metastases.

CASE 668 of the Bone Sarcome Registry was that of a rapidly growing tumor of the lower end of the right femur of 3 months' standing in a male, aged 45 years, with very extensive multiple cartilaginous exostoses dating from childhood. Roentgenograms of the sarcoma showed a large soft parts shadow with blotchy irregular islands of increased density in its central portion, suggestive of chondrosarcoma. However, the sections showed only mixed cell sarcoma without evidence of calcification or ossification. These must have been taken from a portion

of the tumor remote from the areas casting the shadows in the roentgenogram. The patient was alive and well 5½ years after wide local excision of the lesion followed by radium treatment. While the roentgen-ray appearance of this case was typical of chondrosarcoma, the microscopic sections that were registered would not permit of its classification with this group, although sections from other portions may have shown cartilaginous tumor. However, it may indicate that sarcomata originating in cartilaginous exostoses are not always mainly of cartilaginous nature.

Sarcomata arising from enchondromata, according to Mayer, Cornil and Coudray, and Daganello, are essentially of cartilaginous nature, but they may grow rapidly, lose their capsules, and become very polymorphic. They are more frequent than sarcomata arising from exostoses. The so-called benign chondromata invading veins and producing metastases are in reality chondrosarcomata of slow growth and low grade malignancy. Chondrosarcoma may arise from the costal cartilages, but I have found no instances of their origin from the other cartilages of the body.

That metastases from chondrosarcomata are also cartilaginous and may calcify and ossify is shown by the following case:

Male, aged 34 years, had had, in another hospital, amputation of the upper third of the left thigh for tumor of the lower end of the femur which was diagnosed as chondrosarcoma. He died 1½ years later with pulmonary metastases and hypertrophic pulmonary arthropathy. I obtained a portion of lung from autopsy, an X-ray of which is shown in Figure 37. It presented numerous nodules varying in diameter from 1 to 5 centimeters. On cut section they were composed of hyaline cartilage with scattered areas of calcified cartilage and bone. These areas cast the blotchy shadow shown in the X-ray. Microscopic examination showed the tumor to be composed very largely of hyaline cartilage which, in the growing peripheral regions, shaded over into round cell precartilage and in the deeper regions was calcified and ossified (Fig. 38).

SUMMARY

Bone sarcomata consisting largely of cartilage are best designated as chondrosarcomata. Ten cases were found among 61 bone sarcomata studied.

Irregularly branching strands and islands of calcification and ossification develop in many of them, which cast characteristic blotchy shadows in roentgenograms, making it possible to diagnose the condition pre-operatively.

Central chondrosarcoma of the shaft of a long bone may stimulate marked surrounding new bone formation leading to the laying down of a thick wall about it and a thickened shaft beyond it. This also gives a characteristic X-ray picture.

Some of the chondrosarcomata arise from enchondromata and cartilaginous exostoses.

Invasion of the veins with the formation of a cartilaginous tumor-thrombus has been observed in a number of cases.

Of the 10 cases reported, 1 is alive 10 years after excision, 1 is alive 9 years after amputation, and 1 is alive 3½ years after amputation. This in conjunction with the history of long duration in another case (E. K.) would perhaps indicate a better prognosis than that for osteogenic sarcoma.

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THE TREATMENT OF PERNICIOUS ANÆMIA BY LIVER FEEDING[1]

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IN August, 1926, Minot and Murphy (15) recorded for the first time convincing evidence of the therapeutic effect of feeding liver to patients with pernicious anæmia. Since then, their results have been adequately confirmed by a long series of observers, so that today the value of liver in the disease is an accepted and established fact. The events prior to this important therapeutic discovery, and the correlated facts which have been observed since that time, have added greatly to our fundamental knowledge of the disease as well as its treatment.

In 1920, Whipple and his associates introduced the idea of feeding liver, by emphasizing its beneficial action in accelerating the regeneration of blood in dogs made anæmic by bleeding. In the following year, Felton published a brief note in the *Iowa State Medical Journal*, in which he stated that encouraging results had been obtained in pernicious anæmia by the use of a diet which contained small amounts of liver and of foods rich in iron. In 1923, Gibson and Howard reported elaborate metabolic studies on patients with pernicious anæmia and recommended the use of an iron-rich and vitamin-adequate diet containing liver.

It was not until 1926, however, that Minot and Murphy (15) published the epoch-making contribution, in which they clearly demonstrated for the first time two important points: (1) that the red blood cell count of patients with pernicious anæmia could be restored to a normal level by the simple procedure of feeding from 120 to 240 grams of liver daily, and (2) that, within a few days after the beginning of the treatment, there is a striking increase in the number of reticulocytes or immature red blood cells in the peripheral blood.

Also in 1926, Koessler, Maurer, and Loughlin published their observations stating that a definite relationship exists between a state of chronic vitamin deficiency and certain anæmias. They recommended a high vitamin diet as treatment and suggested that the meat of the diet should consist of liver, kidney, sweetbreads, or brain in 100-gram amounts daily. These observers further stated that this diet was the most promising procedure in the treatment of certain anæmias, especially pernicious anæmia. It is now generally believed that this diet was successful in the treatment of pernicious anæmia on account of some specific factor in liver and kidney rather than its high vitamin content.

In 1927, a year after the original contribution of Minot and Murphy, was published the work of Minot and Cohn (5), in which they reported the elimination of a high percentage of non-essential substances in liver without impairing its potency and gave to the world liver extract for the first time. Stimulated by the introduction of a new and efficient remedy for this otherwise fatal condition, many workers initiated investigations which have thrown important new light upon this disease. One of the first to take advantage of this opportunity was the late Francis W. Peabody of Boston, who appreciated that a unique opportunity was offered to study the bone marrow by biopsy. By this method it was possible to observe the marrow of a patient during a relapse and again after a remission had been induced by feeding liver. His studies confirmed the work of Zadek, who had observed that the bone marrow was red and contained an increased number of megaloblasts during a relapse, and became yellow and fatty during periods of remission. Peabody explained the anæmia of the relapse as due to the functional ineffectiveness of the bone marrow, which results from the failure of the megaloblasts to differentiate toward mature erythrocytes. He suggested that the results obtained by liver may be due to some factor in liver promoting the development of red blood cells. In other words, evidence was presented which suggested that the anæmia was more the result of impaired blood production than of increased destruction.

[1] Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

This work was followed in 1928 by that of Castle and Locke, which contributed information of a most fundamental nature concerning the disease. These observers conceived the idea that pernicious anæmia may be a deficiency disease but argued that it could not be due to a deficiency of liver in the diet, for it is frequently absent from the diet of unaffected persons. They assumed, therefore, that there might be some deficiency in digestion, and this is in accord with our knowledge that all patients with pernicious anæmia, with possibly rare exceptions, have an achylia gastrica. To test this theory, they fed 300 grams of rare Hamburg steak to normal individuals and removed the gastric contents 1 hour later. This was then incubated and finally administered daily to patients with pernicious anæmia. In 8 of the 10 patients so treated there was an effect entirely comparable to that of liver. These observations were controlled by feeding either normal gastric contents or Hamburg steak alone to patients with the disease and thereby demonstrating that both materials were ineffective when fed separately. It was concluded that these observations might indicate some deficiency, in the gastric juice of patients with pernicious anæmia, which was related to the cause of the disease. On the basis of this work Sturgis and Isaacs were led to try the effect of desiccated hog stomach in the treatment of pernicious anæmia and demonstrated that it was as effective as liver, if not more so, in inducing a remission of the disease.

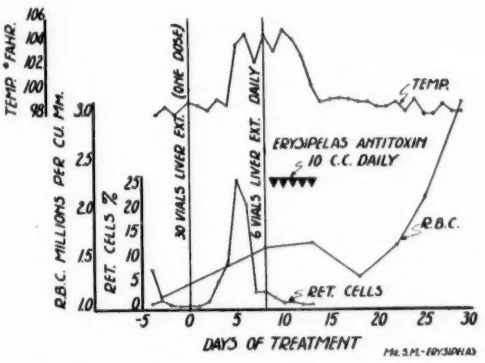

Chart 1. Reticulocyte and red blood cell changes in a patient who developed a severe erysipelas infection. After 4 days of preliminary observation, a massive single dose of 30 vials of liver extract, equivalent to 3,000 grams of liver, was administered. With the appearance of the infection, the body temperature rose, as a result the reticulocyte curve fell, and there was a decrease in the number of red blood cells. In patients with pernicious anæmia without complications, the effect of a single massive dose of liver extract usually persists for 11 or 12 days.

THE EFFECT OF FEEDING LIVER

Since pernicious anæmia was first described as a clinical entity by Thomas Addison 80 years ago, it was never demonstrated that any form of treatment produced a prompt and satisfactory remission, until the modern form of therapy was introduced. Furthermore, as Evans states, it has never been demonstrated that any other therapeutic measure definitely prolonged a patient's life for a significant period. The only exception to this statement is that the transfusion of blood in some instances may have prolonged life for a relatively brief interval, but all observers agree at present that this type of treatment had only a temporary effect and that it was not curative. The condition has quite correctly been regarded in the past as an invariably fatal disease. In view of these facts the results of the modern treatment are all the more impressive. The immediate effect of liver therapy is prompt, striking, and, with a few exceptions which will be noted later, consistently obtained in all patients.

If a patient with uncomplicated pernicious anæmia is fed, during a relapse, approximately 240 grams of cooked or raw liver daily, or the equivalent of from 400 to 600 grams of liver in the form of a potent extract, one of the most dramatic changes known to medical science occurs. Within 3 to 5 days after the treatment is instituted, the patient changes from an apathetic, listless individual to one who is alert and interested in his surroundings. Perhaps one of the most important signs of improvement is the remarkable increase in appetite which is in such striking contrast to the usual anorexia experienced by most patients with pernicious anæmia during a relapse. Nausea and vomiting, which may be serious symptoms during a relapse, promptly vanish; the temperature

and pulse rate become normal; the patient rapidly gains strength; and the yellowish tint of the skin disappears within 2 or 3 weeks. The average increase in the total red blood cell count is approximately 500,000 per cubic millimeter per week and at this rate the number of red corpuscles usually reaches normal limits within 6 to 8 weeks. Rarely does one see more constant, rapid, and satisfactory results from therapy in other diseases.

Additional objective evidence of improvement is usually observed in the form of a substantial gain in body weight. In some instances this is striking. One patient, for example, gained 18.75 pounds in 18 days. Another patient gained 23 pounds in 54 days. In a group of 31 patients with reliable data concerning their change of body weight, the average gain in 28 was approximately 8 pounds in an average period of 37 days. In some the increase was even greater than indicated, as the initial weight was determined during a relapse, at which time a variable amount of œdema was present, which disappeared as the blood approached normal. This in part masks the actual amount of body weight gained. In 3 patients there was an actual loss of body weight, which may have been due to a loss of œdema. One patient had a loss of 1.5 pounds in 19 days, another a loss of 1.5 pounds in 18 days, and a third a loss of 0.5 pound in 87 days.

During this period of remarkable clinical improvement, striking changes, both morphological and chemical, occur in the patient's blood. Usually on the third day the immature red blood cells, the reticulocytes, appear in increased numbers and rise from an average of about 1 per cent to an average maximum of 15 per cent on the seventh day, and then decrease to normal within 2 or 3 weeks. This increase in reticulocytes is characteristically observed in pernicious anæmia at the onset of a remission, either spontaneous or induced, and is interpreted as indicating an increased activity of the red blood cell forming marrow. When this rise occurs, it can be confidently predicted that the red blood cell count will reach normal limits, provided an adequate amount of liver substance is administered and no complication, such as an infection, arises. In an attempt to study the curve of the reticulocyte response more closely, Riddle and Sturgis have observed a series of patients with pernicious anæmia, who were given single massive doses of liver extract which were equivalent to 3,000 grams of raw liver. Following such a dose, the percentage of reticulocytes was estimated every 4 hours, day and night, for a 12-day period. With this method of treatment, the extent of the curve was approximately the same as when daily doses were administered. The response, however, was somewhat more rapid, as the increase occurred in 48 to 52 hours, the peak was reached on the fifth or sixth day, and the percentage returned to normal in 10 or 12 days.

Although the response of reticulocytes is prompt, it is not the earliest change which occurs, following the use of liver therapy. Riddle has observed that, beginning within 24 hours after the treatment is started, there is an increase in the urinary excretion of uric acid from 74 to 531 per cent and an increase in the concentration of uric acid in the blood serum from 28 to 239 per cent. It has been assumed that the increase in uric acid metabolism results from an accelerated rate of development of the red blood cells and a resultant increased destruction of normoblast nuclei. Since the above work has been reported, corroborative evidence has been supplied by the work of Krafka. This investigator recently observed that the uric acid excretion was doubled in Dalmatian coach dogs after an anæmia had been produced by hæmorrhage. He likewise concluded that the increase was due to the increased activity of hæmatopoietic tissue in producing red blood cells with the concomitant destruction of the nuclei of the normoblasts.

In addition to the striking change in uric acid metabolism at the beginning of a remission, there is also definite evidence of a constant decrease in the blood sugar level following treatment. Blotner and Murphy in 1929 reported that whole liver had a blood sugar reducing effect. Riddle has recently demonstrated that various commercial liver extracts likewise exhibit this insulin-like effect and

usually produce a decrease in the blood sugar equivalent to about 30 milligrams per 100 cubic centimeters of blood. This decrease begins irregularly during the first week and the maximum fall occurs from within 1 week to 17 days. The cause of the diminished blood sugar following liver treatment is not apparent, but it may possibly be due to an increased demand for carbohydrate.

During the 2 years in which the Simpson Memorial Institute has received patients, we have observed the effect of feeding liver or various types of liver extract to 125 patients with pernicious anæmia. As has previously been stated, the immediate beneficial and striking effect of the treatment is now well recognized and no additional statement is necessary concerning it. The information which is much desired at present concerns the length of time a patient with pernicious anæmia can remain in good health, provided the liver or liver extract is taken continuously in adequate amounts. Unfortunately, an accurate and complete solution of this problem has not yet been obtained, as the treatment has been used for only a relatively brief time.

In an effort to obtain information on the point, the records of a special group of 42 patients observed at the Simpson Memorial Institute were carefully considered. In all of these patients, the clinical evidence of the accuracy of the diagnosis was convincing. Each patient of the group had a red blood count of 2,800,000 cells per cubic millimeter, or less, and they all have been observed for a period varying from 6 to 27 months. Thirty-two, or 76 per cent, had a red blood count of 4,000,000 cells per cubic millimeter, or greater, at the end of a period varying from 6 to 27 months. In most instances the count had returned to normal in 6 weeks or 2 months and remained normal at the end of the observation period indicated in Table I.

Of the group of 42 patients, 2 are dead. One, a woman aged 60 years, was admitted with a red blood cell count of about 800,000 per cubic millimeter. She showed a characteristic response to liver extract with a return of the red blood cell count to normal in about 6 weeks. After a year of excellent health, her death occurred 1 week after a leg fracture. Her blood, 2 months before death, was normal and she continued in good health until the time of the accident. The second patient who died was a woman, aged 56 years, who when first seen had a red blood cell count of 2,700,000 per cubic millimeter. She had rather marked cord symptoms, which greatly interfered with walking. After 1 month of liver treatment, the red blood cell count had increased to 4,200,000 per cubic millimeter, but there was slight, if any, improvement in the spinal cord symptoms. Her death occurred about 1 year after she was first seen at the Simpson Memorial Institute. According to her local physician, the blood remained within normal limits throughout, but the spinal cord symptoms were progressive and a complete paralysis of the lower extremities developed, with incontinence of urine and fæces. For 1 month prior to death, the patient was drowsy and complete coma was present in the last week of her life. Her death must be attributed to the neurological complication incident to pernicious anæmia.

In 10 patients, or 24 per cent of the group observed, the red blood cell count was less than 4,000,000 at the end of a period varying from 6 to 20 months. In each instance, however, a striking improvement in the anæmia has followed the treatment and 9 of the 10 patients had, at some time following the liver feeding, a red blood cell count of 4,000,000, or greater. In other words, 9 of these patients had been successfully treated but had relapsed. These observations are shown in Table II.

It is important to study the causes which account for the failure of the treatment in hope that recognition of its difficulties will be of assistance in the more successful management of patients in the future. In our experience, the failure to obtain desired results in patients with pernicious anæmia was due to three main reasons, as follows: (1) the treatment was not properly administered; (2) the preparations of liver extract were inert or weakly potent; (3) a complicating infection was present.

The most frequent reason for the failure of the treatment is that it is not properly administered. In most instances this is due to

the lack of intelligent co-operation of the patient, despite the careful instructions given by the physician. To treat pernicious anæmia with liver preparations, it is apparently necessary, as with insulin in diabetes and desiccated thyroid in myxœdema, to administer the proper dosage continuously throughout the patient's life. It has been our custom to give ½ pound of liver, or extract equivalent to 400 to 600 grams of liver, daily until the blood reaches normal limits. At this time, the patient may be placed on a maintenance dose, which is somewhat smaller than the initial dose necessary to bring the blood to normal. In our experience, this dose varies somewhat with different patients, but it is usually ½ pound of liver, or extract equivalent to 300 or 400 grams of raw liver, 4 or 5 times a week.

In the matter of the maintenance dose, however, which is so important to the health of the patient, there is only one safe rule to follow and that is to require the patient to report for observation at frequent intervals. At such visits, the most important single criterion of the adequacy of the dosage is the level of the red blood cells. If the red blood cell count is not within normal limits, this is a definite indication to increase the dosage. In a few instances we have observed the red blood cells and hæmoglobin percentage to be slightly greater than normal, but there have never been any severe symptoms referable to this condition, and there has been a prompt return to a normal level following a decrease in the dosage.

One great difficulty, which will always be encountered, is the failure to convince the patients that it is necessary to continue with the medication when they are free from symptoms and their blood is normal. Despite our specific directions to continue with treatment and report at regular intervals, about 20 per cent of all patients at the height of a therapeutically induced remission discontinue all liver or take it irregularly in greatly reduced amounts. The symptoms of a relapse occur insidiously and patients are often unaware that the blood count is reduced until it reaches the level of approximately 3,000,000 red blood cells per cubic millimeter. With the discontinuance of liver medication, a complete relapse with a decrease in the red blood cells from normal to approximately 1,000,000 may occur in 2 or 3 months.

In an attempt to secure better co-operation from the patients, members of the staff of the Simpson Memorial Institute have recently compiled a small manual containing the simple facts concerning the disease and the essentials of the treatment. It is hoped that this effort to educate the individual patient will prove as successful in the treatment of pernicious anæmia as the same method has in the management of patients with diabetes.

Another important cause for failure of the liver treatment in pernicious anæmia is the use of various extracts which are of low potency or are completely inert. This arises chiefly from the fact that there is no simple or strictly laboratory method of assaying the strength of the preparation. The only known method of testing the potency of liver extract is to administer it to an untreated patient with pernicious anæmia and to observe its effect on the red blood cells, especially the reticulocytes. If an adequate amount of potent material is given and the patient has no complication, such as an infection, experience has taught us that the reticulocytes will rise to a maximum level in inverse proportion to the height of the red blood cell count just prior to the beginning of the treatment. For example, if the patient has a red blood cell count of 1,000,000 the reticulocytes will reach a maximum percentage of about 35 per cent in from 6 to 9 days; if the red blood cell count is 2,000,000 the reticulocytes will increase to a maximum of approximately 14 per cent; if the red blood cell count is 3,000,000, there is slight, if any, increase in the reticulocytes, although the total number of red blood cells will gradually rise to normal.

With such a precise response to the administration of liver or liver extract, this constitutes a very valuable method of testing the efficacy of the material. But application of this test meets with serious obstacles, inasmuch as untreated patients with pernicious anæmia are not as common now as previously and, also, not all drug manufacturers have readily accessible clinical facilities to make

the test. Furthermore, each separate lot of liver extract should be tested clinically, for despite careful effort to apply precisely the same methods of manufacture to each quantity of raw material, there may be a wide variation in potency. Until all preparations of liver extract are tested clinically, which obviously is associated with many difficulties, or until a more simple method of assaying the product is devised, the only safe procedure is to give the preparation in what is considered to be adequate doses and to observe its effects on the patient's blood at frequent intervals.

The chief guiding principle in the treatment of pernicious anæmia with liver is, therefore, an exceedingly simple one, that is, to prescribe an adequate amount of the material and use every possible method to have the patient continue with the treatment, even though the blood is within normal limits. There is no evidence to indicate that a special diet in addition is indicated as long as the patient consumes an average and reasonable variety of food. This is usually the case, inasmuch as the patient's appetite is stimulated by the liver therapy to such an extent that a wide variety of food in large amounts is demanded. Unless obviously faulty dietary habits exist, it is usually satisfactory to leave the choice of food to the individual patient. Likewise it is true that there is no convincing evidence that accessory medication, such as dilute hydrochloric acid, is necessary, regardless of the fact that the achlorhydria persists when the blood returns to normal and the patient is symptomless. In a large percentage of our patients a perfect remission was induced by liver extract without additional medication of any type or special attention to the diet.

Of considerable importance in the treatment of pernicious anæmia is the fact that a severe infection may cause the liver treatment to be less effective. The mechanism of this is not known, but clinical observations of the patients with pernicious anæmia who are undergoing the liver treatment indicate that it is true. If a patient's blood has been brought to normal and maintained at that level by the proper maintenance dose of liver or liver extract, a severe infection such as a pyelitis may cause the red blood cell count to fall, even though the dosage remains unchanged. It is desirable, therefore, temporarily to increase the liver therapy 50 per cent in amount, when patients with pernicious anæmia develop any type of infection. The undesirable influence of infection in diminishing the therapeutic value of liver therapy may manifest itself at the beginning of treatment by a less extensive and slower reticulocyte response. If the reticulocyte response has already begun when the infection develops, there is a tendency for the percentage to drop to a low level. An excellent example of this is shown in Chart I.

THE EFFECT OF TREATMENT ON THE CENTRAL NERVOUS SYSTEM LESIONS

As soon as it had been demonstrated that liver has such a remarkable effect in restoring the red blood cells to normal in patients with pernicious anæmia, the question immediately arose concerning the relation of the treatment to the lesions of the spinal cord. This is of great importance because approximately 80 per cent of our patients have involvement of the nervous system, although in many instances this is trivial and consists of only a rather mild paræsthesia of the hands and feet. Many times the latter almost completely disappears, either permanently or transiently following treatment, and in most patients, regardless of the extent of the involvement, there is a definite improvement in the symptoms referable to the spinal cord.

If there is evidence of a widespread spinal cord lesion, with definite indication of injury to the posterior and lateral tracts, the possibility that liver treatment will be of benefit is less promising. This is especially true when there is a disturbance in the sphincter control of the bladder, resulting in urinary retention with a subsequent cystitis. When this occurs, there is superadded the factor of an infection which, as has been previously stated, causes the liver treatment to be less effective.

In general, while it may be said that patients with pernicious anæmia and well marked spinal cord involvement may show a striking improvement with liver therapy, it is true that the neurological symptoms may

TABLE I.—BLOOD COUNT

Name	Initial		Last		Duration of observation, months
	R. B. C.	Hb.	R. B. C.	Hb.	
Wi	1.0	28	4.2	77	27
De	1.9	43	5.1	75	24
Si	2.4	49	4.4	75	24
Wr	1.9	44	4.1	90	23
McC	1.0	21	4.4	80	22
Ca	1.6	38	4.8	81	22
Ge	1.1	19	4.9	90	21
Sm	1.2	24	4.4	85	20
Jo	1.4	45	5.5	95	20
Ha	1.0	15	4.2	82	18
Cr	1.0	24	4.1	53	16
Wa	1.3	33	4.4	99	16
Bo	1.7	53	4.9	80	15
Sch	1.6	28	4.2	74	15
Zi	1.8	30	4.2	89	13
Re	1.4	34	4.3	85	13
Gu	1.0	23	4.4	73	13
Bi	2.0	47	5.5	94	13
Po	.7	12	5.5	93	12
Fl	1.4	37	5.4	100	12
McE	2.5	51	4.8	99	12
Ho	1.3	35	4.6	76	12
Pol	2.1	46	4.5	55	12
Har	1.7	42	4.0	75	12
Ov	1.2	20	4.9	78	10
Ro	2.4	57	4.7	96	10
Os	.9	21	5.3	94	9
Fi	.8	23	4.1	83	9
Ba	.8	24	4.2	76	8
Jon	2.7	58	4.1	81	7
Ki	.5	18	5.3	78	6
Co	1.5	40	4.3	79	6
Average	1.4	34	4.6	82	14

NOTE.—The initial red blood cell count and hæmoglobin estimation represent the condition of the patients' blood when first admitted to the hospital during a relapse. The last red blood cell count shows the effect of liver or liver extract therapy after a period varying from 6 to 27 months as indicated in the last column on the right. In almost all instances, the blood rose from its initial low level to normal in 6 to 8 weeks.

remain stationary or may progress, even though the liver is given in the most efficient manner which is known at present. The latter statement is of considerable importance, because, with the introduction of this form of therapy to restore the blood and maintain it at a normal level, it was hoped that, if pernicious anæmia were recognized before the appearance of serious cord symptoms, involvement of the nervous system might be prevented. While further experience is desirable before definite conclusions are reached, it is obvious at the present time that the effect of liver therapy is much less marked on the symptoms due to involvement of the nervous system than it is on those referable to the hæmatopoietic system.

The same statement may be applied to various lesions other than those of the blood, which are frequently involved in pernicious anæmia. For example, the troublesome glossitis may disappear promptly when liver is administered. Starr and his co-authors have reported a remarkable instance of this and we have seen it in many patients. A few patients, in whom there has been a recurrence of the glossitis, even though the blood has remained at a normal level, have been observed.

These facts emphasize a point of importance which should always be considered when appraising the effect of the treatment of pernicious anæmia. The benefit of the treatment should not be judged solely by any single criterion, but from the entire clinical picture, including the patient's symptoms, physical signs, and laboratory examination. It is probably true that the red blood cell count is the best single evidence of the status of patients, but a few have been observed who have shown a satisfactory response so far as was indicated by a return of the red blood cells to normal level, yet the hæmoglobin remained as low as 50 per cent of normal. These patients are still under investigation and it is possible that some other cause for the persistently low hæmoglobin may be discovered, such as occult bleeding or an associated malignancy. Even though their red blood cell count is normal, it cannot be stated that this group of patients has responded in an entirely satisfactory manner to treatment. Likewise, the blood may be changed by treatment from a severe anæmia to an entirely normal appearance and, with this, the patient may show a striking increase in strength and a remarkable general improvement, yet he may still be completely incapacitated by severe neurological symptoms.

TYPE OF MEDICATION DEMONSTRATED TO BE EFFECTIVE

It has been demonstrated that liver, either cooked or raw, prepared according to innumerable household recipes, is effective in

TABLE II.—RESULTS

Name	Initial		Last		Interval of observation, months	Highest		No. of months after treatment was begun that highest count was reached	Cause of failure
	R. B. C.	Hb.	R. B. C.	Hb.		R. B. C.	Hb.		
Cl	2.2	35	3.2	70	20	4.8	85	1	Lack of co-operation.
Mi	1.5	28	3.6	70	20	4.3	76	4	Lack of co-operation.
Be	1.1	22	3.4	73	19	5.9	92	8	Insufficient liver.
Ho	1.5	26	2.9	72	18	4.2	80	7	Impotent extract.
Or	1.1	21	3.9	70	16	5.3	76	3	Lack of co-operation.
Bo	1.4	26	2.9	60	13	4.1	70	5	Impotent extract and infection.
Ba	1.9	41	3.4	69	12	4.2	92	4	Lack of co-operation.
Le	1.8	35	3.0	69	11	5.3	80	5	Lack of co-operation.
Sch	1.0	23	2.5	74	11	4.7	70	4	Lack of co-operation or impotent extract (?).
Ki	1.1	22	3.3	62	6	3.5	62	3	Impotent extract.

NOTE.—In 10 patients, or 24 per cent of the total group considered, benefit was derived from the liver treatment, but the results were classified as unsatisfactory because the red blood cell count was less than 4,000,000 per cubic millimeter at the end of the observation period. In every patient except one (Ki) the blood had reached normal limits at some time after the treatment was instituted, but a partial relapse occurred for various reasons as indicated in the column on the extreme right.

the treatment of pernicious anæmia, if given in adequate amounts. There appears to be no therapeutic difference between the effect of beef, calf, or hog liver, although most patients prefer calf liver on account of its better taste and texture. Also it has been demonstrated that kidney, when fed in amounts of ½ pound daily, produces the same effect as liver (McCann). If a series of patients with pernicious anæmia is treated exclusively with raw or cooked liver, it soon becomes apparent that it is exceedingly difficult in many instances for some individuals to continue ingesting a sufficient amount of liver or kidney daily. Some patients have a natural dislike for such foods and others, after a variable period during which they have consumed their prescribed portion daily, develop such an aversion to this form of treatment that they discontinue it despite all warnings that a relapse will follow. On the other hand, there have been some patients who have managed, without difficulty, to consume the required amount of liver over long periods, and a few have even developed a keen appetite for it.

Fortunately for those who were unable to continue taking liver, Minot and Cohn and their collaborators (5, 6, 7, 16) began several years ago to eliminate by chemical methods the constituents of liver which were non-essential to the therapeutic effect in pernicious anæmia. After a long series of experiments, which they have reported at intervals, they produced an active liver extract (fraction G), a few grams of which are equivalent to 100 grams of raw liver. By the use of this preparation, the equivalent of 500 or 600 grams of liver may be taken by a patient 4 or 5 times a week over long intervals, without difficulty and with an entirely satisfactory result. These same observers have pursued their investigations further, in an attempt to isolate the pure active principle, until they have produced an experimental product which, in as small amounts as 0.6 gram daily, is sufficient to cause a satisfactory effect in patients with pernicious anæmia. According to the last report on these experiments, this fraction is free from fat, protein, and carbohydrate, and various reactions indicate that it has the chemical nature of a nitrogenous base.

In addition to the investigations of Minot and Cohn, important work has been done by West on the nature of the material in liver; Reznikoff reported the successful administration per rectum of an extract made from cod liver; and Collip has developed a less complex

method of preparing liver extract. Recently Castle (4) has reported a simple household method of preparing an extract, which can be accomplished without knowledge of chemistry and with the use of ordinary kitchen equipment.

In reviewing the modern therapy of pernicious anæmia, it is interesting to note briefly that desiccated hog stomach has recently been observed (Sturgis and Isaacs) to be effective in the treatment of the disease and evidence suggests that, per gram of fresh material, it is more active than liver, as a smaller amount of material is required to induce a remission. This observation is of great theoretical interest, as it is in accord with the experiments of Castle and Locke and indicates that normal hog stomach tissue contains a red blood cell maturing substance. Whether the therapeutic effect is due directly to an active hæmatopoietic agent which is contained in the stomach wall, as it apparently is in liver and kidney, or to some unknown mechanism, is not yet clear.

The observation that stomach preparations are effective in pernicious anæmia is of considerable importance from a practical standpoint, as they have only a slight odor and practically no taste. In addition, it appears possible to produce a stomach preparation which will be much less expensive than the preparation of a corresponding amount of liver extract.

SUMMARY

Our observations may be summarized as follows:

1. Patients with pernicious anæmia show striking improvement following the use of adequate amounts of liver or potent liver extract.

2. Within 24 to 48 hours after treatment is begun, characteristic chemical and morphological changes may take place in the blood, thereby indicating that further improvement will occur if the treatment is continued.

3. The treatment may partially fail if it is not properly administered, if a severe infection develops, or if there is extensive involvement of the central nervous system.

4. Desiccated hog stomach and hog stomach defatted with petroleum benzine produce a satisfactory hæmatopoietic remission in pernicious anæmia.

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BLOOD REGENERATION IN SEVERE ANÆMIA[1]

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THE results which Whipple and Robbins have obtained in four series of experiments in regeneration of the blood in severe anæmia may be summarized as follows:

OPTIMUM IRON THERAPY AND SALT EFFECT

The optimum dose of iron by mouth in these experiments is about 40 milligrams iron as metal daily, added to the basal ration iron. Above this level of intake, a large excess of iron salts gives no further rise in the production of hæmoglobin.

Iron has been given in the form of ferric chloride, ferric citrate, ferrous carbonate, ferrous sulphate, and ferrous ammonium sulphate with similar results. The average weekly output of hæmoglobin on the optimum iron salt intake is very close to 25 grams hæmoglobin.

The basal ration of bread contains 20 milligrams of iron as metal per 300 grams bread as fed.

The optimum total intake of iron exceeds threefold the loss of iron by bleeding and wastage of red cells. It is obvious that this iron has some effect in the body other than that of mere replacement of iron in the lost or worn out hæmoglobin.

This iron in excess of hæmoglobin iron requirements obviously exerts some influence upon internal body metabolism so that more hæmoglobin is produced. This may be designated as a salt effect and is probably similar to the effect noted with feeding salt mixtures, copper and other metals, and ash from tissues.

Iron is the most potent metal so far tested in severe secondary anæmia due to hæmorrhage in dogs.

INFLUENCE OF MANGANESE, ZINC, COPPER, ALUMINUM, IODINE, AND PHOSPHATES

Manganese by mouth causes very irregular responses, sometimes favorable for hæmoglobin regeneration, sometimes not. Manganese is probably somewhat less potent than copper salts, which also are uncertain in their reaction in this type of experiment.

Zinc in these experiments shows reactions which are practically negative.

Iron salts in various combinations with manganese, copper, or zinc, give hæmoglobin production levels almost exactly similar to the production expected from the iron alone. There is no evidence for summation of these effects.

Aluminum and antimony in the dosage which is employed show no evidence of a potent effect.

Potassium and calcium phosphates have little if any influence upon hæmoglobin regeneration.

Sodium iodide is to be classed as almost inert and it may even at times inhibit somewhat the salt effect of iron or copper.

INFLUENCE OF LIVER AND BLOOD SAUSAGE, VEAL, EGGS, CHICKEN, AND GELATIN

Liver sausage as tested in these experiments shows a moderately high potency for new hæmoglobin production, which depends upon the amount of liver contained in the sausage. The output of new hæmoglobin averages about 40 to 50 grams during a period of 2 weeks.

Blood sausage also is quite potent in these experimental anæmias in dogs. It may run as much as one-half the potency of whole liver. Its potent factors are whole blood, meat scraps, and a little liver. It is probable that the contained blood is responsible for almost half the total effect.

Liver and blood sausage deserve careful study as to their applicability in various human anæmias. As accessory diet factors, they may prove to be quite valuable.

Calf skeletal muscle (veal) is as potent as any skeletal muscle so far tested and is in the class with beef heart. In these standard dogs, the production of hæmoglobin will average close to 25 grams for 2 weeks, which is about one-fourth the average value for liver.

[1] Abstract of paper presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

Egg yolk and egg white are relatively inert and the average hæmoglobin production is about 10 grams for 2 weeks above control levels.

Chicken skeletal muscle (white or dark) is a little less potent than calf muscle; chicken bones and skin still a little below chicken muscle.

Gelatin feeding in large amounts will increase somewhat the hæmoglobin output above control levels. It corresponds closely to the effect of beef muscle. We may say that gelatin adds something other than tyrosine or tryptophane to the standard bread ration, which enables the body to fabricate a considerable amount of new hæmoglobin.

INFLUENCE OF SPINACH, CABBAGE, ONIONS, AND ORANGE JUICE

Spinach and cabbage (red and white) show but a moderate effect on hæmoglobin regeneration in standard anæmia experiments. We may say that from 10 to 12 grams of hæmoglobin per week above control levels represent their influence on blood regeneration.

Iron in optimum dosage added to the spinach ration may give complete summation, that is, the total effect as a rule will amount to the moderate spinach effect plus the larger iron salt effect. This may indicate that the spinach effect is not due to iron in this vegetable.

Onions are almost inert when tested in these anæmia experiments.

Orange juice likewise is almost inert under these experimental conditions.

There is no evidence that various pigments which may be abundant in many fruits and vegetables have any influence on hæmoglobin regeneration.

Chlorophyll likewise appears to be wholly inert in these experiments with long continued anæmia in dogs.

It seems extremely unlikely that vitamins are in any way concerned with new hæmoglobin production under these conditions.

OBSERVATIONS ON THE TREATMENT OF ANÆMIA[1]

WILLIAM P. MURPHY, M.D., BOSTON
Peter Bent Brigham Hospital

THE treatment of anæmia is of interest to both the physician and the surgeon: to the physician particularly because of the striking benefits which result from the use of liver in pernicious anæmia, and to the surgeon because of the importance of a knowledge of the most efficient treatment of the secondary anæmias from various causes. In the realm of surgery perhaps no complicating symptom is so uniformly present as that of anæmia. Not only does it influence the work of the general surgeon, but also that of the various specialists—the neurological surgeon, the urologist, and the obstetrician.

Confirmation of the prompt and striking effect of liver in the treatment of pernicious or Addisonian anæmia has been plentiful since the beginning of this form of treatment about 5½ years ago. Although much is yet to be learned in regard to the effective substance or substances in liver, many facts have been established concerning its use.

As was early anticipated, the effective principle has been demonstrated in fairly large amounts in substances other than liver and probably in small amounts, or in an inactive form, in still others. The active principle has been obtained in a small fraction which is available for general use in the form of a crude extract to be taken by mouth. A purified extract essentially free from the substances which will reduce blood pressure and which may be used intravenously has been prepared successfully by Dr. E. J. Cohn of the Department of Physical Chemistry of Harvard Medical School and used in several cases by Dr. Minot. This extract contains solids which are by weight about one-half of one per cent of the original liver substance. How the active substance does its work is yet to be learned; studies are under way to determine the exact chemical composition of the extract.

Dr. Castle's monumental work on the use of predigested muscle meat in anæmia has helped us to understand the nature of the disease and the rôle which the achylic stomach plays in the etiology of the disease. Dr. Castle showed that, whereas the ingestion of 250 grams of beefsteak has no demonstrable effect on the blood, if this amount be suitably mixed with normal gastric juice, its ingestion daily will have an effect on the blood comparable to that of about 180 grams of liver. Normal gastric juice alone does not have this effect. This observation indicates that the mixture of meat with normal gastric juice permits the liberation of an active principle comparable in its effect on the blood to that supplied by the feeding of liver. The absence of this reaction in the achylic stomach may have a very direct influence in the development of pernicious anæmia. That the effective substance in liver is not one of the known vitamins has been quite definitely established. Although it is entirely possible that dietary measures other than the use of liver, or an effective substitute, may influence the general condition of the patient, they must be considered as of definitely secondary importance.

It is not my intention to enter into a detailed discussion of this subject, but I would like again to emphasize a few important points. From a clinical standpoint, certain very important facts are available. As was early anticipated, liver itself is not a cure for pernicious or Addisonian anæmia and it is only through continuous and intensive treatment that the best results are obtained. The treatment must be so regulated that the blood will be kept in an essentially normal state. In addition to a red blood cell count of 5,000,000 or more cells per cubic millimeter, it is no doubt necessary to maintain the normal morphological features of the blood. With the blood in this condition, our experience suggests that the soreness of the tongue may be avoided, the diarrhœa which occasionally is present in this disease may be relieved, and not only may one expect to avoid the progression of neurological changes, but there will be improvement in these symptoms if they are present when treatment is begun.

[1]Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

In order to obtain the best results, treatment must be regulated to meet the needs of the individual. A drop in the red blood cell count and, in consequence, the possibility of increase in symptoms may be brought about not only by the ingestion of an inadequate amount of liver or effective substitute, but also by the occurrence of an infection or some other complicating factor. Complicating factors, other than the acute infections, which occur not infrequently are such conditions as cirrhosis of the liver, arteriosclerosis, pyelitis, and diseases of the gall bladder. If operation be desirable in the presence of any of these complications, it will be necessary again to increase the quantity of substance which is being used for the relief of the anæmia.

The occurrence of pregnancy must also be considered as a complication requiring very careful observation and an increase in the amount of liver. If spinal cord changes be present, obviously it would be unwise to allow the pregnancy to continue, because of the danger of an increase in the symptoms due to the probable drop in the red blood cell count. Any drop in the red blood cell count must be considered as of serious import, because of the possibility of the increase or onset of the very distressing neurological changes.

From the laboratory standpoint, the prompt and definite increase in the reticulocytes, or young red blood cells, following the onset of therapy as suggested early in the use of this method, has been most interesting and helpful in determining the effect of liver, or an effective substitute, on the patient. It is possible by means of the reticulocyte reaction to determine, during a period of from 4 to 10 days after treatment is started, the potency of the material fed and to predict the effect upon the red blood cell count.

Other interesting effects of treatment, as observed in the laboratory, are the rapid elimination of the excess of bilirubin in the plasma as indicated by a drop in the icteric index. An increase of the white blood cells and blood platelets occurs and the red blood cells, which are enlarged during the stage of relapse, return to an essentially normal size.

It is surprising indeed that in spite of the very important observations concerning the effect of dietary measures on anæmia in animals, as carried out by Dr. Whipple and his collaborators, there is still a dearth of accurate information to determine the most effective treatment in man of the so-called secondary anæmias from various causes. This is, no doubt largely because of the great difficulty of evaluating the effect of various types of therapy on anæmia in general, a problem which can be solved only by using the several methods of treatment in a series of cases of one type due to a common cause. The scarcity of convincing reports as to the best method of treatment in secondary anæmia probably results also from the following causes: (1) failure to advise the feeding of liver in adequate amounts; (2) failure properly to differentiate between the causes of the anæmias; and (3) administration of certain ineffective substances now available and branded "for use in the treatment of anæmia."

That liver, if given in sufficient amounts, is effective in the treatment of secondary anæmia due to certain causes has been demonstrated beyond question. It is also true that improvement will follow the use of large doses of iron in certain types of anæmia. In order to discuss this subject satisfactorily, it is necessary to classify the anæmias into 6 groups, according to the cause, as follows:

1. Anæmia resulting from acute loss of blood. In this condition there is generally no diminution in the iron reserve and rapid improvement will occur, provided the patient is in general good health. If this anæmia be severe, transfusion may be necessary as a life saving measure, or to prepare a patient for operation.

2. Anæmia resulting from chronic loss of blood. Spontaneous improvement under these circumstances may be very slow and indeed may never be of sufficient amount to bring the patient back to a totally normal condition. This is probably due to the great diminution in the iron reserve, which may be difficult to replace, unless bleeding is stopped. In these cases, transfusion generally has only transient effect, although it is distinctly valuable preceding a necessary operation. After elimination of the source of bleeding, liver or iron, or the combination of the two, in sufficient

amounts and in proper form, will generally relieve this condition rather rapidly. Liver extract is of little or no value. Liver may be used either cooked rather lightly by broiling or as the raw liver pulp. Just what is the most effective means of administering iron has not been definitely determined. Mettier has observed a more prompt and greater rise in the reticulocytes in secondary anæmia following the administration of iron with acid, or an acid iron preparation. That the quantity administered be large is probably of greater importance than the form in which it is given, although there are undoubtedly many preparations of iron which are inert.

3. Anæmias of the nutritional and chronic chlorotic types. Although the chronic loss of blood, or other complications may play a rôle in the development of such conditions, certain pathological states such as achylia gastrica, or a deficiency in the diet may be primarily the cause of the anæmia. Anæmias of these types often improve rapidly following the regular ingestion of a diet containing generous amounts of green vegetables, fruit, and red meat. Improvement will be enhanced by the employment of measures effective in anæmia from hæmorrhage. It may be necessary, however to give even larger amounts of liver or iron than in the latter condition.

4. Anæmia occurring during pregnancy or acutely at the puerperium, due to no clearly recognized cause. The anæmia which arises in pregnancy is influenced favorably by large amounts of liver or of iron, liver extract having little effect. The acute severe anæmias following labor are probably influenced favorably either by transfusion, liver, or liver extract.

5. Anæmia due to chronic infection. It is essential to remove the cause of this anæmia before treatment is begun; otherwise little improvement will be obtained. The same treatment may be employed as in the cases resulting from the chronic loss of blood.

6. Anæmia caused by certain diseases or toxic agents. It may be found in nephritis, tuberculosis, leukæmia, Hodgkin's disease, cancer, and other conditions.

The results of any form of treatment will usually be unsatisfactory until the cause of the anæmia is removed. Each case is, however, an individual problem and many variations in the anæmic state occur, some of which may be influenced favorably by intensive treatment of a proper sort.

Anæmia is a much more common symptom than is ordinarily supposed. So called neurasthenia, or even mild psychoses, and various states of malnutrition and weakness may result from only a moderate diminution of the hæmoglobin over a long period of time. Proper treatment of the anæmia will often cause striking improvement in the patient's general condition.

The value of liver in treatment of conditions other than anæmia must be determined by critical observations of its effect on groups of similar cases. A small group of patients with biliary cirrhosis showed apparent improvement in general condition and a drop in the bilirubin content of the blood plasma following the ingestion of rather large amounts of liver. Judgment as to the effect of the liver must be influenced by the knowledge that spontaneous remissions may occur. Observation of a small group of patients with idiopathic chronic purpura hæmorrhagica, who have taken liver regularly in large amounts, show sufficient evidence of improvement to warrant further studies along this line.

That liver causes in some persons an improvement in the appetite and so allows a higher caloric intake, with a resultant gain in weight, is of definite interest. This is perhaps because of the effect of the substance contained in liver which reduces blood sugar. Further studies concerning the value of liver in the treatment of the diabetic are being carried on.

I have only briefly commented upon some aspects of the work on the treatment of anæmia which is being carried out at the Harvard Medical School and its allied hospitals and which in large part forms the basis for the opinions expressed here. Much of the work to which allusion has been made, and which has been carried out in response to the original stimulus of Dr. George R. Minot and by the co-operation of many individuals, is as yet unpublished.

I am indebted to Dr. Minot and his associates at the Thorndike Memorial Laboratory of Boston City Hospital

and to Dr. John Powers of the Peter Bent Brigham Hospital for assistance. Dr. Minot and I particularly wish to acknowledge the aid given to Dr. Cohn and ourselves by Drs. Means, Christian, Richardson, and Castle, in studying clinically the nature of the substance effective in pernicious anæmia.

DISCUSSION

DR. CHARLES A. ELLIOTT, Chicago: You have listened with interest and, I am sure, with profit to the papers just read by pioneers in the work of extending the horizon of medical knowledge in this particular field.

You who have followed the work of Dr. Whipple and his associates on pigment metabolism since 1917 have found in their studies an example of persistent, logical, and unbiased pursuit of a problem seldom equaled in medicine. This has culminated in the establishment of an idea, namely, that blood pigment regeneration and bile pigment excretion can be modified at will by diet, and has prompted the suggestion that liver feeding be tried in the treatment of the anæmia of pernicious anæmia. This work is one of the recent outstanding contributions of physiology to clinical medicine.

Following the reading, at the meeting of the Association of American Physicians in May, 1926, of the paper by Minot and Murphy on the clinical results obtained by feeding liver to patients with pernicious anæmia, and the subsequent publication of the paper in the *Journal of the American Medical Association*, August 14, 1926, this method has been given a world wide trial and has received universal support as detailed in the paper of Dr. Sturgis.

Since then our knowledge not only of the type of anæmia seen in pernicious anæmia but also of the nature of pernicious anæmia independent of the blood state has been greatly extended by such men as Sturgis, Cohn, Isaacs, Starr, Castle, and many others whose interest in clinical investigation has been stimulated by the results obtained by this treatment of a disease which previously had resisted all forms of treatment.

A few of the results that this study has demonstrated may be stated as follows:

1. The blood state of pernicious anæmia is but one feature of that disease. It represents a type of anæmia occasionally seen in other diseases, notably in sprue, and this type of anæmia responds typically to liver feeding wherever seen.

2. In addition to the hæmopoietic system, the gastro-intestinal tract and nervous system are also affected in pernicious anæmia. These may be independent of any demonstrable anæmia. One encounters posterior lateral cord degeneration, recognized by competent neurologists as pernicious anæmia, without anæmia, and gastro-intestinal manifestations of anacidity, glossitis, anorexia, nausea, and diarrhœa in patients with pernicious anæmia whose blood is maintained in approximately normal state by liver feeding. The gastro-intestinal and nervous manifestations of pernicious anæmia are little, if at all, influenced by liver feeding, even though the blood state is maintained at normal by this means.

3. The consensus of opinion is that pernicious anæmia is a deficiency disease, either dietary in the sense that certain necessary substances are wanting in the food intake, or, more likely, a functional deficiency, in that some necessary secretion—an enzyme or a hormone—is lacking in the individual, which makes it impossible for him to utilize blood forming elements.

4. Not the least valuable result of this form of treatment and the effects produced thereby has been the stimulus to clinical investigation which the opening of a new avenue of approach in the investigation of this and allied diseases has offered.

DR. A. C. IVY, Chicago: We have, in the papers of Drs. Whipple, Sturgis, and Murphy, excellent examples of the application of strictly physiological observations to the treatment of disease. Dr. Whipple, working with dog, has proved conclusively that certain dietary factors, especially liver, markedly increase the building of hæmoglobin by the blood-forming organs. The feeding by Minot and Murphy of liver to patients with pernicious anæmia with almost miraculous results constitutes a milestone in the progress of experimental medicine. But why liver and certain other tissues possess this curative property is still an unsolved problem.

The observation of Sturgis and Isaacs that whole stomach is as effective as liver, and the observation of Castle that gastric contents from persons with normal gastric secretion also is effective, attracts the interest of any physiologist interested in the physiology of gastric secretion.

In 1926, Dr. Farrell and I observed the occurrence of anæmia in gastrectomized dogs. Of these, 2 died of a grave anæmia before we could find a cure. In a third dog, which we have had anæmic on 6 different occasions during the last 5 years, we found that the anæmia could be controlled with cod liver oil by mouth and iron subcutaneously. Raw or cooked liver was not effective because it caused a severe diarrhœa. Liver extract was effective. Not all dogs deprived of the digestive function of the stomach develop anæmia. We have 5 such dogs in the laboratory now, with anæmia in only 1 other than the "5-year" dog. The blood picture of this anæmia in dogs does not resemble that of pernicious anæmia in man; neither does it resemble that of chlorotic anæmia. It is not due to hæmorrhage. In a dog rendered anæmic by the Whipple method, kept in that state for several weeks, and then gastrectomized, the blood returned to normal on a stock diet within a month. Another dog while anæmic became pregnant and aborted at 6 weeks. It should be pointed out in this connection that the dog may be so biologically constituted that he will not develop the picture of pernicious anæmia as presented by man. Similar work should be done on monkeys.

Being struck by the occasional occurrence of anæmia in dogs deprived of their gastric function, by the occasional occurrence of pernicious anæmia in

gastrectomized human beings, by the relation of achylia gastria to pernicious anæmia in man, and by the atrophy of the gastro-intestinal mucosa in man, we thought that the mucosa of the stomach might produce a substance that had an action on the blood forming organs. In the spring of 1929, Mr. Burgess, Mr. Morgan, and myself, in co-operation with several physicians, fed daily from 400 to 500 grams of partially cooked gastric mucosa from hogs, to 4 pernicious anæmia patients with negative results on the blood picture. The administration of pepsin also gave negative results, but those of liver feeding were positive. The results obtained by Sturgis and Isaacs show that whole stomach has a positive effect, which indicates that the effect of whole stomach is due to its muscular tissue, or a combined action of both muscular and mucosal tissue.

The work of Castle, referred to by Dr. Murphy, indicates that the normal *in vivo* gastric digestion of meat produces a simple protein substance which has an action on the blood forming organs. Because he obtained negative results with meat digested *in vitro*, or outside the body, he thinks that gastric juice contains some specifically acting substance. This is not necessarily true, however, because digestion in the body occurs at a more rapid rate, unless special precautions are taken, than digestion outside the body. Another fact that bears on this point is that raw meat is the only one of the common food substances which contains a natural secretagogue and that gastric digestion of other foods produces secretagogues that stimulate the formation of digestive juices in general. It may be that a general improvement in digestion due to the feeding of or production by digestion of secretagogues is the cause of the improvement in pernicious anæmia. Postmortem autolysis occurs at quite a rapid rate in the liver. So far as we know gastric digestion does not produce vitamins. Complete digestion of a food may be necessary, however, to release an essential dietary factor from the food complex.

The beneficial action of liver in diabetes and other conditions may possibly be due to its high vitamin content, since Allen and also Mills have found that certain plant extracts by mouth decrease the insulin requirement. Mills has suggested that vitamin B content of such extracts affords the injured pancreas an opportunity for functional recovery and it has been known for some time that pigeons on a vitamin B free diet have a hyperglycæmia.

From the papers presented tonight, I am sure that we all feel assured that medicine is not satisfied with empiricism but is attempting to determine the whys and wherefores.

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SUPRAPUBIC PROSTATECTOMY WITH CLOSURE[1]

S. HARRY HARRIS, M.D., CH.M., F.C.S.A., SYDNEY, AUSTRALIA

THE operation of suprapubic prostatectomy, it will be readily conceded, has since its inception always fallen short of the true ideals of surgical procedure. The worst feature, of course, has been the inability to secure first-intention healing. Of this the two chief contributory causes have been the lack of precision in the method of hæmostasis and the presence of a ragged postoperative cavity demanding drainage.

As a matter of fact, during the past 30 years comparatively little progress has been made in the actual technique of the operation, the improvement that has occurred in operative mortality being to a large extent due to the pre-operative preparation.

A great deal of effort has been expended on various methods of control of hæmorrhage both by suture and rubber bags and on obliteration of the prostatic cavity by suture. The work of Thompson, Walker, Judd, Lower, Hagner, and Pilcher is outstanding in this respect.

Hitherto, to my knowledge, no attempt has been made to reform any part of the torn prostatic urethra, nor has complete success crowned any efforts at exact control of hæmorrhage by suture.

At the Australasian Medical Congress held in Dunedin, New Zealand, in March, 1927, I showed lantern slides of the technique which I had carried out in 3 cases for the re-formation of the prostatic urethra, and ventured to forecast that with the perfection of this technique "the ideal operation of complete closure of the bladder without suprapubic drainage would then be brought within the region of practical surgery."[2]

It was not, however, until 7 months later that I performed my first operation of complete closure.

Previous to this I had in 10 patients tentatively performed the plastic technique as at present, but in conjunction with suprapubic drainage.

The operation had been designed many months previously, but the needle and needleholder had presented an obstacle to its successful performance. The failures with the many types tried had been numerous and disappointing. Eventually I had constructed the present modification of the boomerang needleholder of Young (Fig. 21), to whose courtesy I am greatly indebted for sending me the original. This latter, long before, had proved too short and frail. The modification fulfills every requirement.

Lower's operation of complete closure appeared in the *Journal of the American Medical Association* on September 3, 1927, and was brought to my notice some 2 months later at a time when my complete operation had already been performed on 17 occasions.

My operation is, however, essentially different in technique from that of Lower, and the immediate and remote results are uniformly much more favorable than those claimed by him or than would seem possible with the technique which he described.

I have always held that there were three *desiderata* for successful closure of the bladder after prostatectomy. First and foremost, the complete control of hæmorrhage; second, the re-formation of the prostatic urethra; and, finally, the obliteration of the prostatic cavity.

The essential features of the operation which I have devised include: (1) a series of sutures in the prostatic bed which provides for complete control of hæmorrhage, obliteration of the prostatic cavity, and re-formation of the prostatic urethra; (2) complete closure of the bladder and abdominal incision, bladder drainage being provided by a catheter in the urethra; (3) removal of the catheter on the tenth day and re-establishment thereafter of natural micturition without further local treatment.

The operation has been practiced in the past 21 months in 110 of 118 consecutive prostatectomies for benign hypertrophy, including 15 two-stage prostatectomies. The

[2]M. J. Australia, 1927, March 26, p. 461.

[1]Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

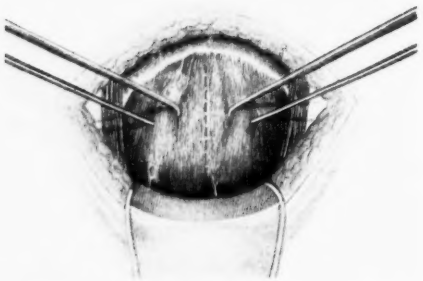

Fig. 1. Bladder exposed, ready for incision. Peritoneal reflection well shown.

first operation was performed on October 15, 1927. There was no death until the eighty-fifth patient. Of the 110 patients, 2 died; 1 on the sixth day from pneumonia, and 1 on the forty-ninth day from inanition. The mortality was 1.8 per cent.

Of the remaining 8 patients who were given suprapubic drainage, 1 died (Case 1, Table I). The total mortality for the series was 2.5 per cent.

Table I shows the reasons for suprapubic drainage in the 8 patients who were so treated.

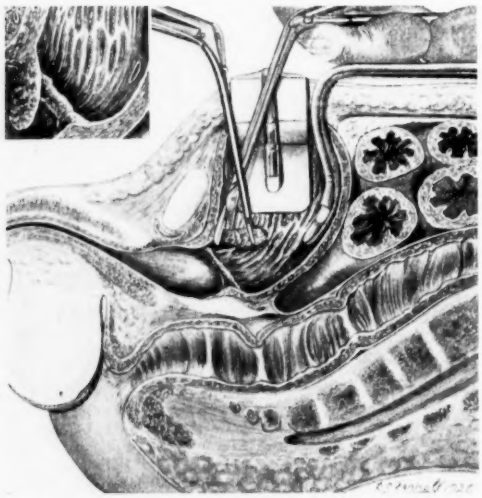

Fig. 3. Sectional view. Removal, from anterior region of sphincter, of adenomatous nodule discovered during systematic review of prostatic cavity after prostatectomy. Inset: Enlarged view of nodule in natural position.

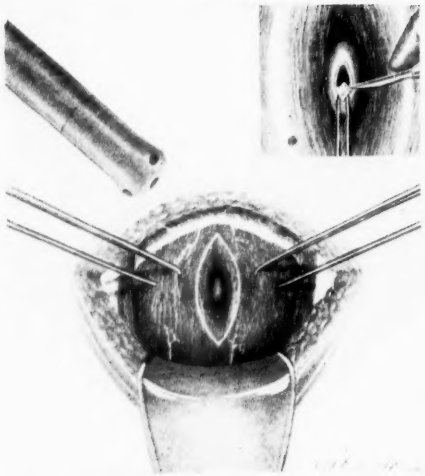

Fig. 2. Layer dissection of bladder. Nozzle of "sucker" ready for insertion. Inset: Method of cutting mucosa.

TABLE I

	Operation	No. of patients
1.	Two-stage operation; fat patient, deep pelvis. Technique incomplete. First stage by author.	1
2.	Two-stage operation; insufficient exposure, low cystotomy elsewhere	2
3.	Hæmostasis incomplete. Early case. Needle trouble	1
4.	Inability to pass the No. 28F. catheter then employed. Early case	2
5.	Presence of 2 foul diverticula	1
6.	Enormous subtrigonal adenoma filling pelvis. Died after 10 days' anuria	1
	Total	8

POSTOPERATIVE HÆMORRHAGE

Postoperative hæmorrhage demanding suprapubic drainage occurred in 4 of the first 22 cases, due chiefly to errors in technique. Two were reactionary and 2 secondary. All of these patients eventually made good recoveries.

In no single instance in the past 88 cases has the bladder been opened after operation at any time for any cause whatsoever.

PRE-OPERATIVE TREATMENT

The pre-operative technique which I employ has been previously dealt with at length.[1] Here it is only necessary to state that prostatectomy is not undertaken until the bladder is

[1]Surg., Gynec. & Obst., 1927, xlv, 692.

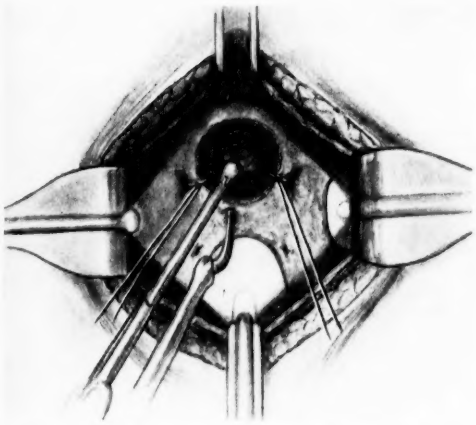

Fig. 4. Beginning insertion of needle for central, crown, or reconstruction suture.

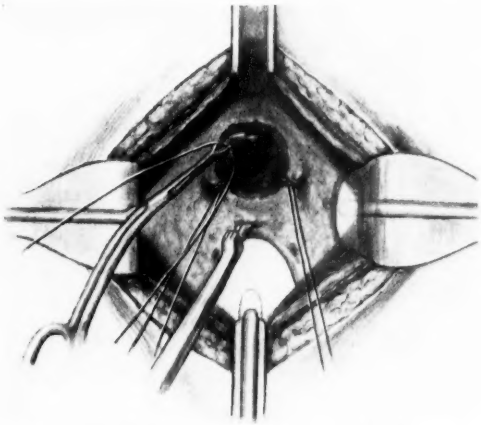

Fig. 5. Needle in position ready to receive the suture from the suture carrier.

clean enough to warrant closure with safety, and that practically any bladder possessed by a patient whose renal function is good enough can, except when complicated by the presence of a foul diverticulum with a small orifice, be rendered clean by the following technique, viz.:

a. The retention catheter is connected by glass and rubber tubing to a bottle at the bedside containing antiseptic. I do not believe that any method of antisepsis will clean up a dirty bladder, or prevent infection of a clean one, when the catheter is drained into a urinal between the patient's thighs. The catheter is changed at least every third day. A hot bath and urethral irrigation with 1:5,000 solution of oxycyanide of mercury is given between changes. A cream consisting of 1:500 oxycyanide of mercury in tragacanth and glycerine is used for catheter lubrication.

b. Bladder irrigation with weak solution of permanganate of potash (of a light pink color) is practiced once or, in dirty cases, twice daily. Back and forth washing is carried on until the return is clear when the permanganate solution is completely washed out with plain sterile water.

c. Four ounces of 1:3,000 solution of nitrate of silver is then run into the bladder and the catheter clamped for half an hour, if the patient will tolerate this strong solution so long. In very dirty cases even stronger solutions up to the limit of tolerance should be employed. The dirtier the bladder, the greater as a rule the tolerance for nitrate of silver. It is rarely possible, nor is it necessary, to exceed a greater strength than 1:1,250, and even this strength will often not be tolerated. Nitrate of silver used by this method has yielded in my ex-

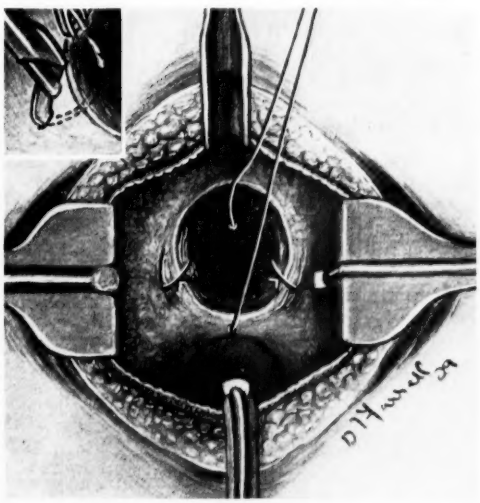

Fig. 6. Prostatic cavity after prostatectomy. The electrically lighted retractors are in position; the two lateral hæmostatic sutures have been inserted and tied. The median reconstructive suture is in position but not tied. Inset: Passage of the left lateral suture by means of the special needle and needleholder and ligature carrier.

Fig. 7. Suture half tied.

perience infinitely better results than any of the newer mercurial preparations.

My experience, also, so far as preliminary vas ligation is concerned, is in complete accord with that of Young. In a long series of operations there has been no case of epididymitis when vas ligation has been practiced at the beginning of treatment.

OPERATIVE TECHNIQUE

Prior to operation the patient's thighs, genitals, and lower abdomen are surgically prepared.

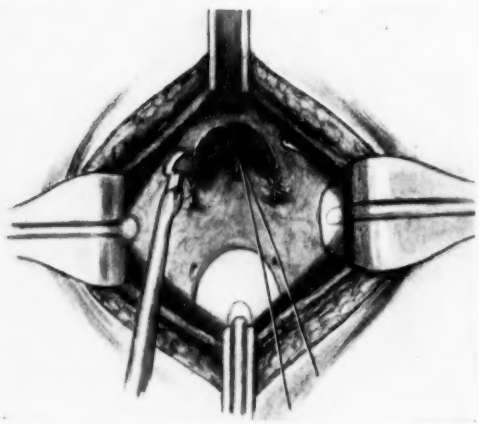

Fig. 9. Needle passed and ready to take the first anterior transverse, deep obliterative suture.

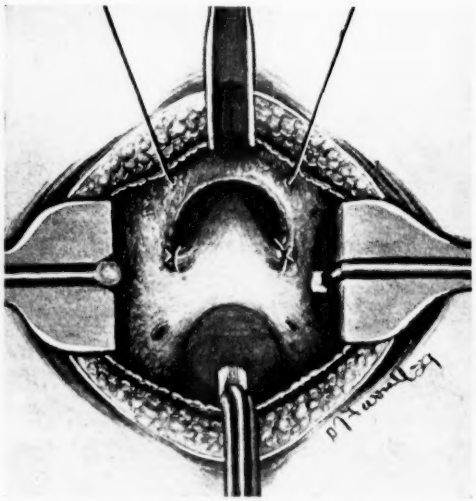

Fig. 8. The median reconstructive suture tied, drawing a tongue-shaped flap of trigone well down into the prostatic cavity, and re-forming the floor of the prostatic urethra. The first anterior deep obliterative transverse suture is in position but not tied.

Immediately before the patient is brought to the operating theater, the bladder is washed out and completely emptied, the catheter removed and the urethra thoroughly irrigated with 1:5,000 solution of oxycyanide of mercury.

After the induction of anæsthesia the sheets and towels are so draped as to allow access to the rectum, genitals, and operation area separately without soiling the field of operation. Two gloves are worn on the left hand, the outermost of which is to be removed after the bimanual enucleation of the prostate.

A transverse skin incision is made 1 inch above the top of the symphysis and from 2 to 2½ inches in length, occasionally longer in very fat patients. The aponeurosis is cut vertically to the required extent. There is no undermining of the fat or of the aponeurosis. The bladder is picked up with tissue forceps and the peritoneum is reflected to its summit. The bladder is then opened vertically by layer dissection and any remnant of lotion evacuated through the nozzle of a suction apparatus. (Figs. 1 and 2.) There is complete absence of soiling of the abdominal parietes by urine and lotion flowing over them.

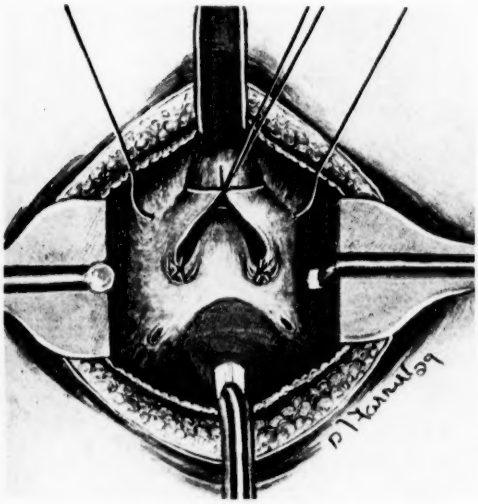

Fig. 10. The first anterior stitch tied; the second in position, but not tied. Portion of the deep part of the second suture can be seen running deeply across the prostatic cavity just beyond the apex of the trigonal flap.

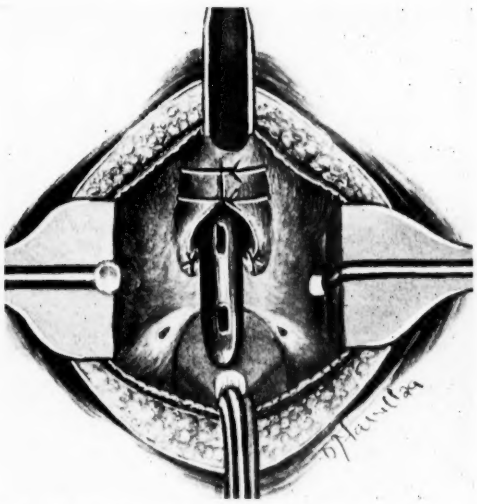

Fig. 11. The plastic operation completed; the control of hæmorrhage is complete. Catheter in position. Note that ample room is left for drainage upward alongside the catheter into the bladder.

The bladder incision is lengthened and retraction sutures inserted.

The intra-urethral method of bimanual enucleation of the prostate is next carried out and the prostate is removed. The special curved lithotomy forceps, which are employed for the delivery, compress the prostate in its long axis and greatly facilitate this step.

The author's electrically lighted bladder retractors are then inserted. Of these, two lateral and one posterior are routinely used, an anterior being added where there is any "overhang" in front such as occurs in patients with deep pelves (Figs. 6, 8, 10, 11, 18, 19, 20).

The prostatic environs are carefully reviewed, any glandular remnants are removed, and the ragged portions are trimmed up so that a nice, clean, rounded orifice remains (Fig. 3).

CONTROL OF HÆMORRHAGE

The gross hæmorrhage in most cases is readily controlled by insertion of two sutures in the rim of the prostatic cavity at the positions of 4 and 8 o'clock respectively, 12 o'clock being considered the midline anterior (Fig. 6). At one or both of these points a bleeding artery or vein can generally be seen. The suture should be tied in front of the bleeding point if arterial, behind if venous. This is quite important, as inaccurate application of the sutures necessitates their multiplication. Very occasionally an additional suture on one or both sides may be required.

The persistent ooze from the prostatic cavity will be taken care of by its obliteration at a later stage.

The author's modifications of Young's boomerang needleholder and ligature-carrier armed with No. 2 plain catgut are used throughout for placing the sutures at the bladder neck. (Figs. 21, 22, and 23.)

THE RE-FORMATION OF THE FLOOR OF THE PROSTATIC URETHRA

To accomplish this step of the operation a long pair of angular ring forceps (Fig. 24) is passed into the prostatic cavity and picks up the prostatic capsule at a point low down on the posterior wall. This can generally be vizualized, though it is not material.

The boomerang needle is now passed entering the mucosa at the position of 6 o'clock and from ⅓ to ½ inch behind the prostatic

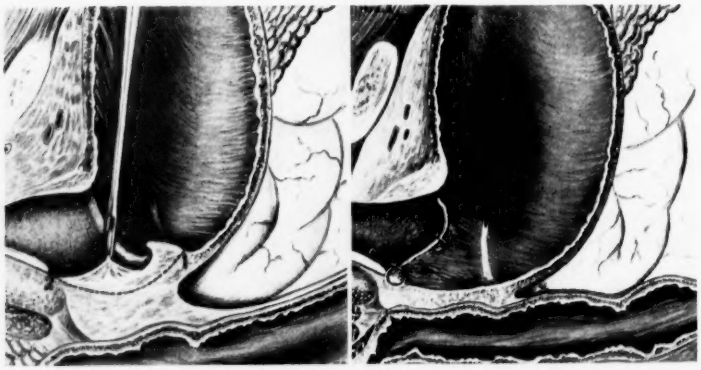

Fig. 12 (left). Sectional view showing the method of picking up the prostatic capsule prior to the passage of the median reconstructive suture. The track of this is indicated by the dotted line running between the numerals *1* and *2*, which represent the points of entry and exit of the needle.

Fig. 13. Sectional view showing the trigonal flap in position re-forming the floor of the prostatic urethra. The median reconstructive and right lateral hæmostatic sutures are shown.

rim, emerging deeply in the prostatic cavity, passing below and behind the tissue previously caught up by the ring forceps, and either just picking up or just missing the torn edge of the prostatic urethra (Figs. 5, 6, 7, 8, 12, 13, and 14).

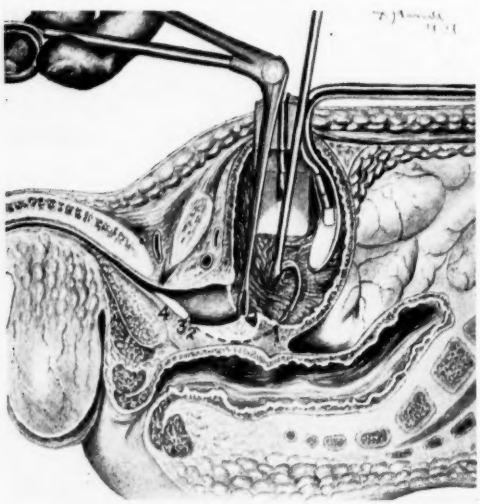

Fig. 14. Similar view to Figure 12 showing the method of insertion of the median reconstructive suture. The right lateral and posterior electrically lighted retractors are in position. The forceps have picked up the prostatic capsule preparatory to the passage of the needle, which passes either through or adjacent to the torn edge of the prostatic urethra. The numerals *1* and *2* represent the point of entry and exit of the needle. The numeral *3* is the torn end of the prostatic urethra, and *4* is the verumontanum.

This medium posterior suture passes very deeply through the trigone, so that the whole thickness of the underlying muscle is included in its bite. A thick muscular flap with a good blood supply is thus insured.

The tying of this suture not only reforms the floor of the prostatic urethra, but also straightens out the trigone, gives to its muscle a *point d'appui*, and puts it in position to resume its physiological rôle of pulling open the internal sphincter during the act of micturition. That this flap remains in the position in which it has been sewed has been amply proved by repeated cystoscopic and cystographic examinations at varying periods after operation. The possibility of the persistence of obstruction, or its recurrence from ledge-formation at a later date is hereby obviated, and any necessity for postoperative urethral dilatation disappears.

OBLITERATION OF THE PROSTATIC CAVITY

For this purpose two deep anterior transverse sutures are used, traversing the prostatic cavity from side to side and including in their bite portions of the internal circular and external longitudinal muscle-fibers of the bladder, which constitute the normal internal sphincter. When these sutures are tied, the

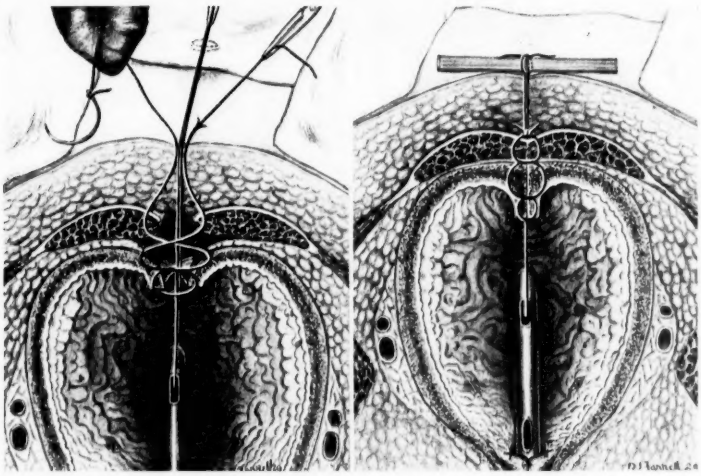

Fig. 15 (left). The method of insertion of the single extended figure of 8 suture which is used for bladder closure. The ends of the silkworm gut suture transfixing the catheter are seen passing out above this suture.

Fig. 16. Sectional view of the completed operation seen from below. The extended figure of 8 suture tied, and the space of Retzius obliterated. The catheter is tethered in position to the glass rod lying on the abdominal wall. Note the valve-like inversion of the cut edges of the bladder.

muscles on each side are brought together in the midline. There results from this, in some cases at least, a practical *restitutio ad integrum*.

The first stitch (Fig. 8 and 9) passes deeply in the plane of a tangent to the foremost part of the prostatic ring, penetrating the mucosa well out on each side, taking a large bite both in a lateral direction and deeply, and just skimming the floor of the prostatic cavity in the depths. This stitch is tied and its ends held taut while the second stitch is passed parallel to the first and about ⅓ inch further back (Figs. 10 and 11).

These sutures when properly placed should afford complete control of hæmorrhage.

If anything beyond the slightest oozing persists, as may happen when a specially large growth has been removed, a third transverse suture is inserted posterior to the second.

This completes the plastic stage of the operation.

PLACING THE RETENTION CATHETER

A No. 22F. rubber catheter, which has had a second eye cut 1½ inches from the tip, is now passed through the urethra into the bladder. It passes below and behind the anterior transverse sutures, lies on, and is enfolded by the strong tongue-shaped flap of trigone which forms the floor and sides of the new prostatic urethra (Figs. 11 and 16).

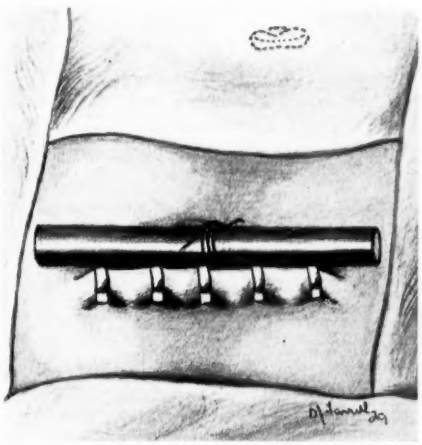

Fig. 17. The operation completed. The skin incision is closed by Michel clips. The ends of the silkworm gut, the loop of which transfixes the catheter, are wound in opposite directions around glass rod and tied in half surgical knot.

Fig. 18. The posterior bladder retractor. (One-fourth actual size.)

Fig. 19. The right lateral bladder retractor. (One-fourth actual size.) Note the lamp is placed near the bottom of the blade.

Difficulty in passing the catheter may arise in two situations; at the glans penis and in the newly formed prostatic urethra. The former difficulty is met by meatotomy. In the prostatic urethra, the tip of the catheter sometimes finds its way into the cul-de-sac on either side of the trigonal flap. This is easily overcome by passing the left forefinger into the rectum and the right down to the prostatic urethra and having the assistant gradually insert the catheter until it impinges upon the right finger tip which then guides it into the bladder. This maneuver is more satisfactory than the use of a catheter guide, which is liable to injure the trigonal flap.

The tip of the catheter is drawn up out of the bladder and transfixed by a needle armed with a length of silkworm gut. This latter is used to tether the catheter to a glass rod laid along the front of the abdominal incision. The free ends of the silkworm gut are clipped by a pair of artery forceps. The catheter is then withdrawn into the bladder and so adjusted that the second eye comes to rest at the entrance of the newly-formed prostatic urethra (Fig. 11).

The catheter lies loosely in the newly-formed urethra, ample room being left for

Fig. 20. The left lateral bladder retractor. (One-fourth actual size.) Note the lamp is placed near the top of the blade.

drainage alongside it upward into the bladder (Fig. 11). Tight suturing around the catheter, as around a rubber tube in any other situation in the body, is to be deprecated also on the ground that it is very prone to be followed by sloughing with resultant secondary hæmorrhage.

CLOSING OF THE BLADDER INCISION

One suture only of No. 3 plain catgut is routinely employed. It is of an extended figure-of-eight type with three loops, which embrace in order the aponeurosis and recti muscles at the lower angle of the incision, a good bite of the muscular wall of the bladder on either side ¾ inch external to the incision, and finally the cut edges of the bladder.

Valvular closure of the bladder, obliteration of the space of Retzius, and closure of the lower angle of the incision in the aponeurosis are thus accomplished (Figs. 15 and 16).

The ends of the silkworm gut, which is used to transfix the catheter, emerge immediately above this suture.

Two mattress sutures of No. 4 plain catgut are placed in the aponeurosis above this. A continuous fat suture and from four to six Michel clips complete the closure.

The free ends of the silkworm gut suspension suture are now wound, each in an opposite direction, snugly around a short glass rod which lies flat along the abdominal incision. The ends are tied in a half surgical knot and left long, and the abdominal dressings are applied.

The catheter in the urethra and the bladder are now syringed with 3 or 4 ounces of 1:5,000 solution of oxycyanide of mercury to free

Fig. 21. The combined needle and needleholder. Author's modification of that of Young. The dotted lines show the range of excursion of the needle and of the telescopic handle. (One-third actual size.)

Fig. 23. The suture carrier for the needleholder. (One-third actual size.)

them of any retained blood clots. A glass tube of the same caliber as the catheter is fixed in its end, and placed in a glass bottle containing antiseptic until the patient is returned to bed.

TWO-STAGE PROSTATECTOMY WITH CLOSURE

As has been stated, the operation is applicable to two-stage prostatectomies, but with certain definite reservations; namely, the preliminary cystotomy incision should be placed not less than 1½ inches from the top of the symphysis, and at least one month should be allowed to elapse between operations for subsidence of the wound induration.

The incision is carried vertically downward, and there are added, if necessary, two lateral incisions which radiate from the fistulous opening.

Special narrow-bladed electrically-lighted retractors are necessary on account of the restricted space available. There is rarely, however, any particular difficulty in carrying out the complete plastic technique. These cases are, of course, more likely to leak during the early part of the convalescence than the one-stage prostatectomies, but it is surprising how little leakage actually occurs.

There is of course no reason why the hæmostatic plastic technique on the prostatic cavity should not be applied through the ordinary wide abdominal incision with daylight exposure, should the operator so desire. Personally I employ this exposure on occasions

Fig. 22. The author's needles for use with the needleholder. The larger is 1⅜ inches, the smaller 1 inch in length.

Fig. 24. The forceps for picking up the prostatic capsule. (One-third actual size.)

when diverticula also have to be removed. There is naturally a greater liability to infection of the perivesical planes and abdominal parietes, and it is probably safer to use rubber dam drainage in the space of Retzius for a day or two after operations in which this exposure has been used.

THE AFTER-TREATMENT

The convalescence is extremely easy for both patient and attendants. For the first 24 or 36 hours a careful watch must be kept on the catheter to see that it does not become obstructed by small clots. The urine during this period, though blood-stained, should be quite transparent. When there is any doubt as to the continuity of the drainage there should be no hesitation in injecting into the bladder at any time ½ ounce of 1:3,000 solution of nitrate of silver, though no set irrigation is employed.

The catheter is connected up to a bottle at the bedside and is retained in position until the tenth day. Very rarely is there any urinary leakage from the wound during this period. Immediately before the removal of the catheter 2 ounces of 1:3,000 solution of nitrate of silver are injected into the bladder. To remove the catheter it is necessary only to cut

Fig. 25. Alligator scissors for trimming the prostatic cavity. Those shown cut toward the right. Another pair, which cuts to the left, is also valuable.

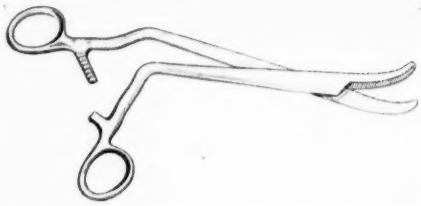

Fig. 26. Hæmostatic forceps of occasional use for application to the prostatic rim.

across the silkworm gut suspension suture at the skin level. The hairpin-shaped remnant of silkworm gut comes away with the catheter. The nitrate of silver solution is generally passed *per urethram* within ½ hour, and natural micturition follows thereafter.

No urethral dilatations have been found necessary at any time after operation.

Occasionally from the fifth to the tenth day the wound has become puffy and elevated and fluid is evidently present. In such cases it has been found necessary merely to pass a pair of sinus forceps through the skin alongside the silkworm-gut suture. Blood stained, turbid, or even offensive pus has been evacuated through this small opening which generally closes in 2 or 3 days without any urinary leakage. There is not that tendency to infiltration of the abdominal parietes which is associated with infection in a large transverse incision when no drainage is employed.

In some few of the cases there has been urinary leakage through the wound after removal of the catheter, but this has been short-lived.

The patient is out of bed on the eleventh day.

CONCLUSIONS

The operation as described brings suprapubic prostatectomy into line with modern operative procedure, and may fairly be described as an operation of precision.

The operation has been practiced in 110 out of 118 consecutive prostatectomies in the past 21 months for benign hypertrophy of the prostate, with 2 deaths. The mortality was 1.8 per cent.

Including the 1 patient who died in the series of 8 subjected to postoperative suprapubic drainage, the mortality of the whole series works out at 2.5 per cent.

The technique is applicable to two-stage operations when the preliminary cystotomy has been performed according to the method prescribed.

The operation accomplishes by suture complete and permanent control of hæmorrhage, obliteration of the prostatic cavity, and reformation of the prostatic urethra.

The comfort of the convalescence and the simplicity of the nursing are in marked contrast to the common experience with the usual method of suprapubic drainage.

STANDARDIZATION OF ELECTROSURGERY

Radical Operation for Cancer of the Breast Taken as an Example in General Surgery[1]

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FOLLOWING in the march of industry, surgery is passing from the age of iron and steel to the period of electrical development.

Very early in the art of surgical intervention, the hot iron was used for the searing and separation of pathological tissue. Abscesses were opened, superficial tumors were burned off, and deep incisions were made for gall stones and other abdominal complaints. The sterilizing, as well as the hæmostatic, effects were well understood and appreciated by medieval surgeons, and the literature of that period shows many descriptions of cautery technique. A good textbook was published by C. Bartholinus in 1624, at Hafniæ. A well preserved copy of this excellent treatise may be seen in the library of the Surgeon General, Washington, D. C.

The soldering iron was too slow for modern surgeons, so an electric heating unit was devised to keep the iron hot. The electric cautery became a mighty weapon, and a modern cautery literature began to develop.

Dr. James F. Percy's work on the malignant uterus and Dr. A. C. Scott's operation for carcinoma of the breast by the actual cautery should be mentioned as examples of what can be done with slow heat.

High frequency currents now entered the arena and drew the attention of the surgeons as a whole. Beginning with Professor Oudin's demonstration in Paris in 1893, of fulguration for the cure of superficial cancer, the users of high frequency electricity quickly added electric cutting and electrocoagulation to their accomplishments. The generators were large and expensive and the working tools were awkward and cumbersome and were often the target for humor and satire, but the work went on.

For about 8 years in Germany and in this country, modified radio-transmitters have been used for generating high frequency currents for surgical purposes. There were many objections to these early generators. Fast cutting with insufficient coagulation permitted bloody fields, where the current slowed down or stalled altogether. Irritating spark jump and muscle jerking were also very objectionable.

A recent survey of the surgeons of this country using electricity in the operating rooms gave very interesting information. The object of this survey was the discovery of the kinds of electricity really necessary and desirable in surgical work. It seems that there have been two distinct schools in electrosurgery; the cutting school and the cooking school. Between these there is more or less of a fixed gulf; and what one has found useful the other refuses to investigate. The cutters require fast cutting with minimum coagulation for the skin muscles, etc., so that they may perform rapid and extensive dissections and obtain primary healing. They further require slow cutting with maximum coagulation for the brain, liver, pancreas, lung, and other organs that are delicate in structure and abundant in blood supply. The cookers require a heavy current that is easy to insulate for electric coagulation of large or small areas. They also need a current similar to the original

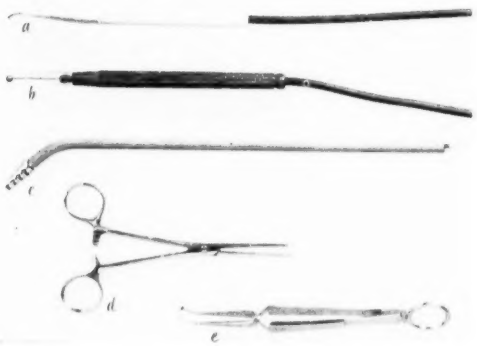

Fig. 1. *a*, Cutter; *b*, coagulator; *c*, insulated suction tube; *d*, Ochsner forceps; *e*, Doyens clamp.

[1]Presented as a movietone film before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

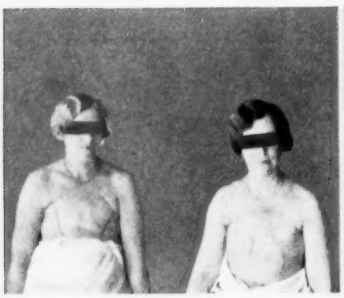

Fig. 2

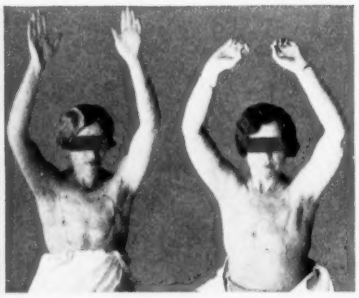

Fig. 3

Fig. 2. Patient on right, breast operated upon 7 years ago. Adenocarcinoma. Left breast operated upon 1 year later for extension growth. Midline incision four and one-half years ago, local recurrence.

Fig. 3. Patient on left, bilateral amputation 7 months ago for adenocarcinoma. Note good functional result.

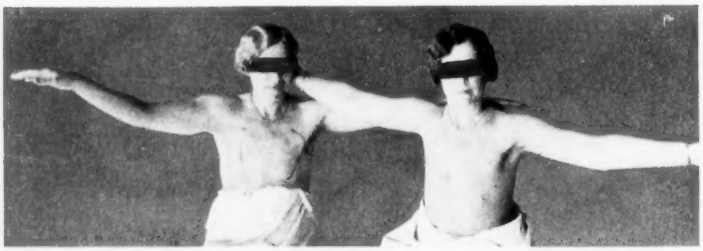

Fig. 4. In order to remove more tissue in all advanced cases we prefer to do a bilateral operation at once.

Oudin current for fulguration and dessication of superficial lesions.

Only a few surgeons were trying to combine the good points in both schools. Of these the brilliant work of Dr. Harvey Cushing on intracranial tumors stands out as the greatest accomplishment of electrosurgery of our time. He used two machines; a cutting and a cooking machine controlled by one switch-board. He called attention to the need of cutting currents of various degrees of coagulation as well as a coagulating current. He also stressed the need of a smooth current of suitable wave form that would eliminate muscle jerking and convulsions.

The result of the survey clearly showed the necessity for both cutting currents and coagulation currents, and to gain speed, it seemed necessary that these currents operate synchronously without the need of a special operator to throw switches or change controls. With this object in view extensive research was made involving all known spark-gap high frequency generators as well as the common radiofrequency transmitters.

It was found that it could be done better by tubes. The result is a small dependable generator that gives three cutting currents, two coagulating currents, and in addition a fulgurating current similar to the original Oudin resonator current. The cutting and coagulating currents operate synchronously and without interference so that as the surgeon cuts the first assistant may use the coagulator to dry up the bleeding points not sealed by the cutter. The coagulating current is of low voltage and easily insulated. A momentary touch is sufficient to seal ordinary bleeding but when large vessels are encountered they are grasped by artery forceps and the forceps are touched with the coagulator. This seals all tissue within the grasp of the forceps.

Fig. 5. Dissection of subclavian and axillary region is completed before the work around the breast is begun.

Sponging has been eliminated in favor of an insulated suction tube, which keeps the field dry without trauma. In deep areas and in friable tissue, such as the lung or the cervix uteri, a momentary touch of the coagulator to this tube seals any bleeder at the exposed tip.

It must be borne in mind that great heat is given off, and if the coagulating current is used too freely, primary union cannot be expected. This is especially true of the skin and mucous membranes.

A classification of all cautery agents suggested by our survey is submitted:

1. Actual cautery—(a) soldering iron, (b) Paquelin cautery, (c) electric cautery.
2. High frequency (spark gap, damped high frequency generator—(a) fulguration, (b) electric cutting, (c) electric coagulation,
3. Radiofrequency (vacuum tube, undamped radiofrequency transmitter)—(a) desiccation, (b) electric cutting, (c) electric coagulation.

RADICAL BREAST AMPUTATION FOR MALIGNANCY

You must not get the idea that removal of the breast and surrounding tissues by the radiofrequency cautery is more complicated and laborious than sharp dissection. On the contrary it is more simple and speedy, as you will see.

Fig. 6. It is thus that the mammary gland with pectoral muscle, the coraco-clavicular fascia, the structures of axilla are removed in one large mass.

We have found sponges and sponging, too traumatic, too time consuming, and too dangerous as regards infection and local implantation of living cancer cells.

High powered suction applied by a medium size, straight metal tube is used to maintain a dry field at all times. This tube is insulated except at its tip and its distal end. If the exposed distal end be touched by the coagulator, the tip of the tube instantly becomes a coagulator. One dozen artery forceps are in readiness to pick up large vessels and one dozen Doyen towel clamps are used at strategic points on the skin margins to maintain traction and when once attached their position is not changed.

The method of procedure is as follows: With the cutting electrode plugged in at medium (fast if the patient is obese); the skin incision is outlined with the same slow stroke and light touch that one would use in drawing

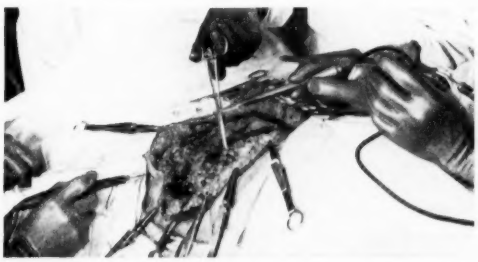

Fig. 7. Coagulator is being applied to a large vessel in the grasp of the forceps. Insulated suction tube at right and cutter at left.

Fig. 8. The dissection has been completed. It will be noted that the entire field is dry.

Fig. 9. Free drainage draws all serum to surface. This serum may contain living cancer cells.

with a fine pen. The first assistant follows the incision with the suction tube to maintain a dry field. He seals small bleeders at once by applying the coagulator to the suction tube for a moment or two. Large bleeders are seized by Ochsner forceps and the forceps momentarily touched with the coagulator.

While the first assistant is handling the suction tube and coagulator, the second assistant places the Doyen towel clamps at strategic points along the skin margins. The clamps serve as retractors and when once placed are not changed during the operation. Clawing the tissues with ordinary retractors causes trauma and may cause implantation of living cancer cells.

With hæmorrhage controlled and the skin flaps retracted, a clear field is always ahead for the surgeon who steadily separates the tissues with the cutter in his right hand and an Ochsner forceps in his left for the occasional spurter. This makes for very fast dissection, as there is no delay of the team as a whole.

You may follow any classical method preferred. We use the incision of W. L. Rodman, clearing out the subclavian structures first. By extensively undermining the skin flaps, the pectoralis major comes into view. It is clamped off near its insertion and severed between clamps with the cutter. The first assistant then applies the coagulator to the clamps and removes them. The structures of the axilla are now beautifully exposed from above.

By carefully maintaining a dry field, the long thoracic is seen just below and parallel with the tendon of the pectoralis minor, while the acromiothoracic appears just above the tendon. These two arteries and accompanying veins are carefully avoided as the tendon is clamped and severed near its insertion into the coracoid process.

The cutter is now plugged in at slow speed, and the costocoracoid membrane opened. This exposes the apex of the axilla and the axillary vein. Dissection now progresses from above downward, gauze being used over the left index finger and the cutter on slow speed in the right hand. As the structures of the axilla are thus uncovered, the pectoral muscles are retracted downward and inward, and an excellent view obtained.

The acromial, alar thoracic, and the subscapular branches of the axillary artery are encountered from above downward; with their accompanying veins, they are carefully clamped and divided and coagulated. The dissection progresses to the base of the axilla where large glands are frequently encountered. As we near the margin of the latissimus dorsi muscle, the long subscapular and the posterior thoracic nerves are identified and preserved. All axillary glands, fat, and the blood vessels and lymphatics supplying the breast have been cleared away before the work on the breast begins. The second skin incision is now made, an inverted cone being outlined about 3 inches at its base, with its tip extending beyond the costal margin about half way to the umbilicus. Extensive undermining is again resorted to, beyond the midline in front and to the

latissimus dorsi muscle behind. This undermining leaves only enough fat attached to the skin to make a comfortable flap. The dissection then uncovers the ribs and intercostal fascia. It is thus that the mammary gland with the pectoral muscles, the coracoclavicular fascia, the structures of the axilla and all surrounding tissues between the skin and the ribs are removed in one large mass. Enough skin should be removed near the primary growth to prevent skin recurrences but the extensive undermining and removal of fat is far more important. Most local recurrences have been in the superficial fat near the midline or near the latissimus dorsi, showing that the undermining has not been extensive enough.

In order to remove more tissue a bilateral amputation is advised in all cases in which the growth has reached an advanced stage.

HOW CAN WE DETERMINE THE EFFICIENCY OF SURGICAL MASK?[1]

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THE fact that the etiological factor in many wound infections after surgical operations could not always be satisfactorily explained aroused my interest in this question. This interest was further stimulated, in August, 1927, when opportunity arose to study 3 deaths from hæmolytic streptococcus infection in a hospital located in a suburb of Boston. These deaths occurred after operations for conditions which should have made possible recovery with "clean" wounds. The patients were operated upon on 2 successive days by the same surgeon with the same assistant and operating room personnel. In each case, evidence of wound infection developed within 24 hours after operation and before the first dressing was done. Wound and blood cultures showed the hæmolytic streptococcus. No focus of infection was discovered in the patients themselves. No other group of infections had occurred in this hospital during recent years.

The customary investigation of sterilizers was carried out and the sterility of catgut and the strength and sterility of the alcohol were investigated. Inquiry was made into the methods of hand and operative field preparation, including examination of these for infected areas. All yielded negative findings. At the same time attention was focused upon the possibility that someone who had assisted in all three operations might have been a hæmolytic streptococcus carrier. We were further moved to investigate this phase of the matter because during this period there was an epidemic of respiratory disease in the area about Boston. It was found that 3 of the 6 people associated with these operations were hæmolytic streptococcus carriers. Incidentally it was found that 50 per cent of the nursing personnel of the hospital were similar carriers. Operating was suspended for a week and after that all found to have hæmolytic streptococci in the mouth or nose were eliminated from the operating room. Since then once a month during the summer and twice a month during the winter and spring, cultures are taken of the noses and mouths of the operating room personnel of the hospital to determine the bacterial flora.

In our investigation it was also found that masks were used to cover the mouth but the nose was covered in but few instances and further that the masks themselves were far from germ proof. A germ proof mask, which will be described later, was then devised. This mask is now worn by all the nurses in the operating suite and by many of the physicians.

The following facts were brought out in an analysis of this series of wound infections:

1. The infections were of a hæmolytic streptococcus nature and occurred at a time when an epidemic of respiratory disease was present.

2. Fifty per cent of the operating room personnel were carriers of hæmolytic streptococci.

3. The masking situation was inefficient.

4. Since that time, following the elimination of streptococcus carriers from the operating room, and the use of a germ proof mask worn by most of the personnel, there has not been a single instance of hæmolytic streptococcus infection.

Another series of wound infections, some of which were due to the hæmolytic streptococcus occurred during the winter and spring months of 1928 and 1929 on a teaching service of another hospital located in Boston. On this service, in addition to the usual operating room personnel, there are also present in the operating room at one time 8 to 10 students and often several visiting physicians. Rigid aseptic technique is adhered to. All in the room wear gowns or white coats, and all mask the mouth and about 50 per cent mask the nose. For better teaching purposes, spectators are allowed to gather about the operating table.

[1]Presented before the Hospital Standardization Conference, Clinical Congress of the American College of Surgeons, October 14-18, 1929.

Figure 1 shows the incidence of wound infection on this service during this epidemic. The upper curve represents the total percentage of wound infection; the lower that of hæmolytic streptococcus infection.

Again, during this epidemic, study of all the customary causes of infection gave negative results. At the same time, the mouth and nose of each surgeon, interne, nurse, and student were repeatedly cultured. This study revealed a large number of hæmolytic streptococcus carriers. A check-up showed that one or more of these carriers had been in close contact with the operations upon those infected with the hæmolytic streptococcus.

Again, study of the masks revealed that they were woefully inefficient, as far as they could be considered germ proof. In the absence of other positive evidence, it seemed fair to deduce that this epidemic of streptococcus infection was probably due to streptococcus carriers inefficiently masked.

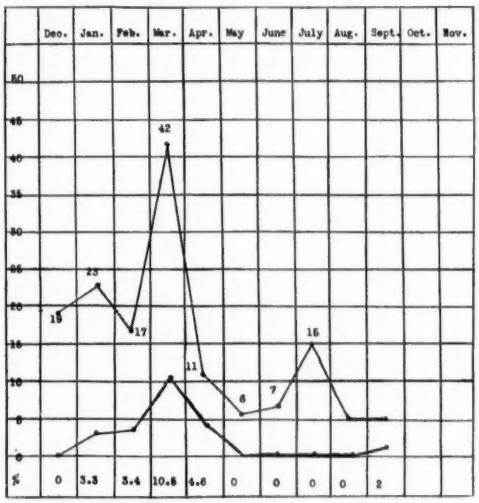

Fig. 1. Cases of wound infection in first hospital. Upper curve, total wound infections; lower curve, hæmolytic streptococcus infections.

Dr. George H. Bigelow describes an epidemic of respiratory disease in Massachusetts in the winter months of 1928–1929. He states among his conclusions that one-fourth of the population was sick with this infection. Thus among our patients and operating room personnel there was the possibility of 25 per cent having active or latent respiratory disease at this time. We note this evidence again to show the possible relationship between epidemics of respiratory disease and those of wound infections due to hæmolytic streptococci.

We do not attempt to explain the large percentage of infections due to organisms other than the hæmolytic streptococcus during this epidemic in the second hospital. Furthermore, we do not wish to create the impression that wound infections as a whole can be traced to those of the operating room personnel who are carriers of pyogenic organisms.

We believe that other factors, including the resistance of the patient to infection, whether from without or from organisms existing in the blood stream or in foci at the time of operation, play an important rôle.

However, we do feel that such carriers of pyogenic organisms, in the presence of an unsatisfactory masking situation, constitute a weak link in our aseptic procedure which may account for a certain number of wound infections.

Naturally, there arose the question as to whether or not other hospitals throughout the country had experienced similar epidemics of wound infection. A questionnaire shown in Figure 2 was sent to 100 hospitals by the American College of Surgeons.

Replies were received from 60 hospitals. From the percentage of replies, one might conclude that the number of wound infections in hospitals throughout the country was not large. Nevertheless, it is our impression that while the number of wound infections in any hospital in a single month is small, the aggregate number throughout the year in the hospitals of this country would be considerable.

In answer to the first question, 16 replied that there had been seasonal epidemics of wound infection; 44 replied in the negative.

In reply to the second question as to the relationship between the incidence of wound infections and epidemics of respiratory disease, 8 agreed that such had occurred, 2 were doubtful, and 50 replied in the negative.

QUESTIONNAIRE

I. If seasonal epidemics of wound infection occurred in your hospital please check the months during which they have occurred:

January	April	July	October
February	May	August	November
March	June	September	December

II. Have these epidemics of *wound infection* been associated with epidemics of *respiratory diseases?*

III. Please indicate the usual custom of the operating room personnel or incidental visitors in masking:

	Mouth only	Nose and mouth
1. Operating surgeon		
2. First assistant surgeon		
3. Second assistant surgeon		
4. Surgical nurse		
5. Assistant nurses		
6. Visiting supervisors or other nurses		
7. Visiting physicians		
8. Other visitors		

IV. Please give a description of the mask used in your hospital or, if you prefer, submit a sample to us for analysis.

Hospital.....

By.....

Fig. 2. Questionnaire relating to the use of masks.

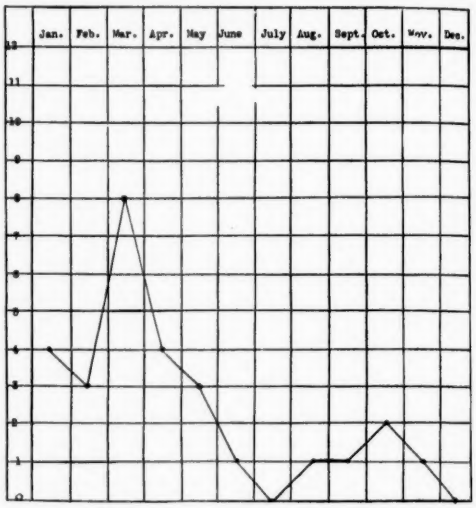

Fig. 3. Monthly curve of wound infections as reported in 14 hospitals.

The curve of monthly incidence of wound infections as reported by those admitting such epidemics is shown in Figure 3. The curve representing the infections during the early months of the year corresponds fairly well with our curve of infections in 1929, in the second hospital, shown in Figure 1.

The answers to the second question would seem to indicate that the larger proportion of hospitals believed that there was not a relationship between epidemics of respiratory disease and those of wound infections.

As indicated earlier in this paper, from our experience we feel that such a relationship does exist. We are convinced, as are other writers, that the prevalence of streptococcus carriers has a decided relationship to that of respiratory disease. We also feel that such carriers have a positive relationship to the incidence of wound infection.

Our view is substantiated by the work of Meleney in a study of streptococcus wound infection in the Presbyterian Hospital for the years 1925 and 1926. We agree with Meleney that while streptococcus carriers are most common during epidemics of respiratory diseases, such carriers may be found at any season or month of the year.

Study of the answers to the third question, regarding the method of masking the various individuals in the operating room personnel, was not of as much positive value as we had hoped, so varied were the replies.

Where those of the personnel in intimate contact with operations masked the nose and mouth, 24.2 per cent of hospitals reported epidemics of wound infection. Of those masking only the mouth, 32.5 per cent reported such epidemics. Slight as the difference is, the evidence nevertheless tends to show that the incidence of wound infection is less when both nose and mouth are masked.

A study of our hæmolytic streptococcus carriers convinced us that the nose less often than the mouth harbors streptococci, and usually a lesser number in the nose in the individual having streptococci in both nose and mouth. This observation may explain why certain hospitals where only the mouth is masked have been fortunate enough to have had few streptococcus wound infections.

With the germ proof mask which covered only the mouth of such a carrier, our experimental work proved conclusively that with streptococci present in both nose and mouth, and with the latter covered with the germ proof mask, these organisms would be deposited upon the Petri dish during the ordi-

nary act of respiration. We concluded, therefore, that masking the nose as well as the mouth should be adopted as a standardized procedure for all those in the operating room.

STUDY OF MASKS SUBMITTED

Our aim in this study was to determine which of the masks submitted could be considered germ proof.

Of 60 hospitals 42 submitted masks for analysis. Of these 42 masks, 22 masks were found to differ either in design, the nature of the material, or the number of layers of the material used. Practical experience in early work on masks was sufficient for us to decide from inspection alone that 15 of the 22 masks studied could not possibly be germ proof and hence were not tested in this respect. That left us 7 masks to investigate.

The minimum standard which we had established for a germ proof mask was that the mask should be so constructed that no organisms could pass through it when the wearer with both the nose and mouth covered talked for one hour's time, during the last 15 minutes of which the area of the mask in front of the mouth was moistened. This might, at first thought, be considered a rather severe test, since no operator would continually talk for 1 hour during an operation. On the other hand, many operations do continue beyond the period of 1 hour's time.

Our investigative work on masks was carried out in the following manner:

The student whose mouth at the time showed the greatest number of hæmolytic streptococci, or, in absence of the hæmolytic streptococcus, the viridans type, was chosen as the subject. An open Petri dish containing culture media was placed in the room but at a distance from the subject. This served as a control for air contamination. We laid stress upon the difference in the bacterial flora found in the air control and that in the dish before which the subject had talked. The use of streptococcus carriers as subjects served as another means of determining whether or not the organisms passed through the masks. On no occasion did we find the hæmolytic streptococcus or the viridans in the air control.

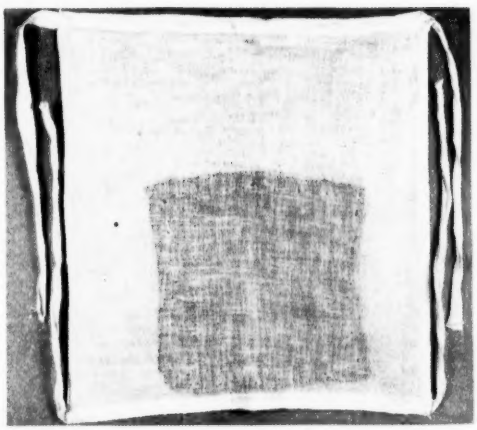

Fig. 4. Mask devised by writer.

The subject, unmasked, read a certain passage from a book for 15 minutes. During the reading a Petri dish lay upon the table in front of the subject at a distance of 1½ feet from the mouth and at an angle of 30 degrees from a line drawn perpendicular from the mouth to the table. With the nose and mouth masked, the same passage was read with another Petri dish in the same position.

The media were then incubated for 48 hours, when colony counts were made of the growths on the three Petri dishes. In making our computation to determine the growth on the dishes exposed to the tests, with and without the masks, we deducted from the count of each of these dishes the number of colonies found in the air control, considering that this represented as near as we could estimate the amount of air contamination. We then had figures representing the number of colonies produced by the subject speaking without a mask to compare with those when the subject wore a mask.

If the count in the dish used when the subject was masked showed a great increase in the number of colonies over that of the air control, the mask was deemed not germ proof. Again, if streptococci were found in dishes used in the test with the subject masked, and, as was the case in each instance, none was found in the air controls, we had further evidence that the mask transmitted organisms.

If the mask seemed germ proof, or in case of doubt, the test was run for one hour during the last 15 minutes of which the area about the mouth was moistened with saliva. If no organisms were then transmitted, the mask was considered to be satisfactory. We would submit this method of procedure for consideration in testing out the efficiency of any mask as to whether or not it is germ proof. We realize that greater accuracy might have been assured had the test been carried out in a room free from organisms. We had no such room available.

Our study of the 7 masks convinced us that none could be considered germ proof. There was variation in the periods of time during which the masks were germ proof, and also some difference in the degree of efficiency in the same period of time. All masks tested transmitted organisms, more freely when damp than when dry.

We then set about to devise the ideal mask, the requirements of which we considered to be:

1. The primary cost should be low to fit in with other economies of hospital administration. For the same reason, the mask should be one that could be used repeatedly, would stand up under laundering and sterilization, and would still remain germ proof.

2. The mask should be comfortable and not unduly warm when worn to cover both nose and mouth, otherwise it would not be readily accepted by surgeons. It should not cause fogging or condensation of moisture on the lenses of those wearing glasses.

3. Lastly, it must not permit the passage of organisms when dry or moist during prolonged periods of conversation.

Although we have given much time and thought to the experimental work, we regret to say that we are unable to present to you the ideal mask. However, we should like to submit a mask for your consideration and analysis. We trust that it may stimulate greater interest in the subject of wound infection and its possible relationship, if any, to carriers of pyogenic organisms and to epidemics of respiratory disease. We trust that eventually the present method of masking will become something more than a perfunctory procedure and that future study will result in the devising of an ideal surgical mask.

The mask which I wish to describe is made in the following manner (Fig. 4): A piece of rubber, 6 inches square (we have found discarded rubber gloves to be a desirable source of supply) is incorporated between two layers of gauze 10 inches square. The edges of the latter are turned in and stitched on three sides. The third side is left open in order to facilitate the replacing of rubber when necessary. The rubber is stitched in at the upper part of the mask where it will cover the area over the nose and mouth. At the upper part of the mask there is incorporated a small piece of aluminum which can be bent to fit the nose of any individual. Tapes are attached to each of the four corners. The mask is worn in the usual way.

Its primary cost is negligible. It can be laundered and sterilized up to five times. It should be made of gauze that is shrunken, otherwise washing may shrink it so that it will be too small. If too small, it will be uncomfortably warm when worn.

If large enough, the mask will be comfortable in the cool weather but rather uncomfortable in hot weather. With conditions of increased humidity, especially in hot weather, there will be fogging or accumulation of moisture on the lenses of glasses. We have overcome fogging by using on the lenses at different times one of several preparations on the market to prevent fogging. We have not been able to overcome the moisture from condensation, which happily has occurred in Boston on only a few days during the year.

The mask has been proved to be germ proof. Theoretically, one might expect organisms to be expelled about the sides, but experimental work has proved that this is not the case.

Until a better mask is devised, it may be useful, should you deem it advisable, to wear at least during the winter months or when an epidemic of respiratory disease is prevalent.

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HOW CAN WE INSURE THE STERILITY OF CATGUT?[1]

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WITH THE ASSISTANCE OF
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IN 1923 in one of the large hospitals in New York City, within a few days of one another, two cases of gas gangrene developed in operative wounds. Clostridium œdematis maligni, the vibrion septique organism, was recovered from both of these wounds. One patient died from the infection. The other recovered following an amputation. The catgut used at the operation was suspected and other tubes from the same batch were cultured and were found to contain not only living vibrion septique spores but several other species of spore forming anaerobic bacteria. The relatives of the patient, who died, accepted it as an unfortunate but unpreventable accident. The patient who lost his leg sued the catgut firm and a judgment was given in his favor. The court made the catgut firm legally responsible for the infection and for the subsequent loss of limb, and in the trial it was brought out that adequate precautions had not been taken to insure the sterility of the catgut.

In 1925 in another New York Hospital, 5 operative wound infections occurred which were symptomatically gas gangrene. These 5 patients were all operated on within 4 days of one another and not one of the 5 survived. The writer had the opportunity of studying one of these cases bacteriologically and found a virulent spore forming anaerobic bacillus of the gas gangrene group. Again the catgut from the batch used during those five operations yielded not only this same organism in two of four tubes examined, but four other species of spore forming bacteria, including the common gas bacillus of Welch—clostridium welchii or bacillus aerogenes capsulatus. This study and a description of the organism, which was thought at the time to be a new species of gas gangrene bacillus, was reported in the December number of SURGERY, GYNECOLOGY AND OBSTETRICS, 1927 (7). It was later discovered that Dr. Sordelli, of Buenos Aires, had found the same organism in an operative wound infection and had reported it briefly in an Argentine journal in 1922 with an abstract later in a French journal. We therefore accorded Dr. Sordelli priority of discovery (5). In a subsequent communication from Dr. Sordelli, the writer was informed that the source of the infection was thought to have been catgut, but material was not available to him for cultural proof.

Close contact with the two disastrous episodes just described led the writer to inquire into the whys and wherefores of such events and to wonder whether or not something could be done to prevent further catastrophes of that nature. The following questions came to mind.

1. How often do these infections occur?
2. How often are they reported in the medical literature?
3. Where does our catgut come from?
4. Does it contain virulent bacteria?
5. How is it sterilized?
6. Do the bacteria resist the "sterilizing" process?
7. Are processes which destroy resistant spore forming bacteria detrimental to other advantageous physical properties of catgut?
8. Are the several steps of the sterilization process checked with self-recording pressure and temperature instruments?
9. How is catgut tested for sterility after it has been put through the sterilizing process?
10. Who can sell catgut?
11. Is there any law or other regulation requiring proof from firms selling catgut of the sterility of their product?
12. Do the firms test their own catgut?
13. Do outside bacteriologists test the catgut for the firms?
14. How often are these tests done?

[1]Presented before the Hospital Standardization Conference, on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

15. Are these tests adequate to reveal any and every living spore still present in the catgut?

16. How often is any attempt made to prove catgut at fault when operative wound infections occur?

17. What methods are used for such tests?

18. Is catgut frequently exonerated by negative tests with ordinary bacteriological methods when it is really at fault?

Considerable time, thought, and experimentation has been given to these and other related questions but I will not burden you with details. Certain pertinent facts, however, have been brought to light which point irresistibly to the necessity for regulation in this matter and for direction of it by some recognizable authority, such as the Hospital Standardization Committee of the American College of Surgeons.

It is difficult to find out how frequently "accidents" of this kind happen. Such cases are not usually reported in the literature. If they occur it is often thought that the less said about the matter the better. Most doctors and many hospitals do not have the facilities for making adequate anaerobic bacteriological tests, and unless a case is proved by culture the evidence is not complete. The doctor may suspect but if he cannot prove, he cannot blame. He *can* change to another brand of catgut, and not infrequently does so. The firm loses a customer and is sorry for that, but it is soon forgotten and nothing is done about it. It is only fair to state that catgut may be wrongly suspected and blamed for certain infections or even deaths due to other causes. Perhaps this is more often true than when it escapes deserved blame, but the fact remains that it has been proved to be at fault on many occasions, and, when it is at fault, serious consequences follow.

A short while ago the writer sent out a questionnaire to 106 surgeons including all of the heads of the department of surgery in the medical schools of the United States and Canada asking if in their experience or that of their staffs any cases of infection or tetanus had occurred attributable to catgut. Of the 49 who replied, 36 gave an unqualified "No." Five said that they had suspected catgut in purulent wound infections but could not prove it. Two suspected but did not prove catgut to be the cause of certain cases of postoperative tetanus. One reported a proved case of tetanus and 2 reported proved cases of gas gangrene. One Canadian correspondent reported a large series of tetanus infections in several Canadian cities attributed to a single brand of catgut.

It is difficult to say whether the 57 who did not reply would have given a greater percentage of positive answers than those who did reply, and it is also difficult to say that this group was a representative cross section of the surgical profession from this particular point of view. Nor can one say that, in the smaller hospitals with curtailed budgets, such accidents occur more often. For several reasons, therefore, it is difficult to find out how often these infections occur. Dr. William Welch wrote me that it was because of the occurrence of gas gangrene proved by him to have been due to catgut that Dr. Halsted gave up the use of catgut entirely and turned to silk. Since then other virtues have been attributed to silk, and catgut may be better prepared now than it was in those days, but the fact remains that Dr. Halsted's pupils and followers all over the country are not using catgut because, first of all, Dr. Halsted felt that there was always the threat of infection.

Catgut ligatures are made from the submucosa of the upper portions of the small intestine of sheep. Certain cheap grades contain some pig gut. After removal from the animal, the contents are stripped out, the mucous membrane and muscular coats are removed and the submucosa is washed, twisted, and dried. It is obvious that it must contain bacteria commonly present in the upper intestine of the animals and that the more resistant organisms will lie dormant in the gut almost indefinitely unless destroyed by heat or chemicals.

There is no legal restriction on the purchase of the raw material; anyone may buy it either fresh or salted, and may prepare it in any way that he sees fit. He may then proffer it for sale to anyone who wishes to buy. The government has rigid laws which limit the selling of impure or adulterated and poisonous foods, but is not at all concerned with con-

taminated catgut. I wrote to the government Bureau of Standards of the Department of Commerce to find out if it had any jurisdiction or control over such matters, and they replied that they had no control over sterility but the Army and Navy had certain requirements for tensile strength. I was referred to the Public Health Service and they too replied that "firms engaged in the preparation of this material are not required to subscribe to any standard test furnished by the "Public Health Service." Finally I appealed to the American College of Surgeons and received a prompt and hearty response. They were eager to find out how I proposed to remedy the matter and promised every possible cooperation to achieve the desired end. The end is simply this—that it shall not be possible for anyone to buy on the market catgut that is not absolutely sterile. I believe that you will all agree with me in this, that there should never be any competition of catgut firms in the matter of sterility. Their products may vie with one another with respect to other physical characteristics—tensile strength, absorbability, and what not, but they should all have the common factor of sterility. There is no relativity about sterility; it is an absolute term which means the absence of living elements.

Now, just as there is more than one way to kill a cat, there are more ways than one to destroy bacteria in catgut. We do not care how they are destroyed but we want to know that they are destroyed. We are not interested in the various processes by which catgut is sterilized, but we are interested in knowing that the final product is sterile. It is for the various catgut firms to find out what processes will destroy the bacteria and retain the desirable properties of catgut.

As far as I can determine, there are ten or a dozen firms in this country selling so-called "sterile" catgut. Many hospitals prepare it for their own use. The firms may be said to be in three categories. First, those which maintain their own laboratory where samples of every sterilized batch of catgut are put through a test to determine whether or not any living organisms remain. Second, those firms which send samples of each batch to neighboring bacteriologists and depend on their reports regarding the purity of the product. Third, still other firms which do not send samples of every sterilized batch but check their methods from time to time by sending occasional samples to outside bacteriologists for testing. It is obvious that if the tests are so designed that the media is not a favorable environment for the growth of certain bacteria known to be present in raw catgut, the tests are worse than useless because they give a false sense of security. In other words, the method must be adequate to detect any living organism which may be present and sufficient time must be given for it to grow out in the medium. Furthermore, no matter how foolproof the method of sterilization may be, something might go wrong, let us say, to be conservative, once in a thousand times and there should be a means of checking up on such failures. In other words, not an occasional batch but every single sterilized batch should be tested. Time and space must be given to store this material until the test is complete, and it must not be liberated, even in emergency, until the tests have shown it to be free from contamination. If a method of culture can be devised which will be absolutely certain to pick up any living organisms no matter how few in number they may be, and if all catgut firms will agree to use this method and test every batch of sterilized catgut, the chance of purchasing an unsterile product by doctors and hospitals would be reduced to a minimum and they could buy with more confidence than they do now. This would extend the field of sale to include those doctors and those hospitals who fear to purchase catgut on the market because of their doubt with regard to the factor of sterility.

Any method which is devised for testing sterility must first be demonstrated to be efficient—that is the *sine qua non* of its acceptability for those who *use* the product, but it must also be as economical as possible and adaptable to large numbers of specimens tested at the same time, in order that it may be acceptable to those who *make* the product. We must first of all demonstrate to the users that the test is the most efficient yet devised and they will accept the products of those

firms that employ the method. Then we must demonstrate to the makers that without any compromise on efficiency it is the most practical method yet devised. We thought of the possibility of attempting to get legislation passed similar to the pure food regulations, but it was obvious at once that this would entail considerable difficulty both in the passage and the enforcement of such a law. On the other hand, the existence of the Hospital Standardization Committee of the American College of Surgeons presented at once a mechanism which would not only initiate the regulations but see that they were consistently and perpetually carried out. An endorsement by the Hospital Standardization Committee of the American College of Surgeons of the products of only those firms who submitted their catgut to this test would rapidly eliminate by disuse those firms which were not willing to yield to this final check up of their goods.

A consideration of the problem had reached this stage when, entirely without solicitation, but greatly to my gratification, one of the larger catgut firms approached the writer with an offer to finance the study of this problem. It was felt, however, that inasmuch as it was a question of vital interest to other firms, it would be better to enlist the interest of several so that it would be evident to the profession and to the firms as well that it was an unbiased study, not favoring the product or the methods of any one firm.

A plan for the study was outlined a year ago and received the approval of the committee on hospital standards of the American College of Surgeons, and the support of four of the larger catgut firms. First it seemed necessary to determine just what organisms we had to deal with. This entailed a review of anaerobic bacteriology and a study of the bacteria occurring in raw catgut. Second, the cultural characteristics of the organisms found in pure and mixed culture should be studied to determine their thermal and chemical death points, their optimum medium, the optimum reaction for the medium, the decrease of oxygen tension required for growth, the length of time required to germinate long hidden spores, the synergisms and antagonisms of these organisms, and their pathogenicity for laboratory animals. Third, a general survey should be made of the methods now being used by the various catgut firms to see if the organisms found in raw catgut could be made to grow by these methods even when planted in high dilution or after prolonged storage. Fourth, a chemical study should be made of the antiseptic storing fluids, their inhibitory effects on the bacteria present in raw catgut and various methods devised for neutralizing their effects. Finally, a method would have to be worked out, possibly combining the best features of methods already in use, or a brand new method, but one which would make certain the growth of any living organism present in catgut, no matter how few they were in number. The method would have to be 100 per cent efficient, first of all, and simple enough to be practical for large numbers of specimens to be tested at one time.

The Hospital Standardization Committee of the American College of Surgeons promised that if the results of this study were entirely satisfactory they would recommend the products of only those firms which were willing to subject their goods to this test, not occasionally but with specimens from every single sterilized batch of material. It was felt that all of the reputable firms would be willing to follow the lead in the matter and adopt the standard test and any firms which did not fall into line would find no market for their goods. If hospitals and doctors the country over then followed the advice of the committee they could buy catgut with perfect confidence and perfect security, and the risk of fatal accidents such as I have described would be reduced to a minimum. There would have to be a constant check up by the committee to see that the test was followed strictly and the name of any firm not complying would have to be immediately removed from the list of accredited firms.

The plan thus outlined has been partially carried out and will be completed during the present school year. The progress made so far seemed to the committee to be sufficiently satisfactory to be presented at this meeting to arouse your interest and to enlist your cooperation so that when the work is done it

may receive your active support and thus the desired effect may be accomplished. This, we hope, will mean not only the elimination forever of mortality and morbidity from contaminated catgut but the elimination also of the fear of such accident. The results of our preliminary study are given in the addenda which appears below.

ADDENDA—PATHOGENIC SPORE FORMING ANAEROBES CULTIVATED FROM RAW CATGUT

It should be understood that the common pyogenic organisms are easily destroyed by relatively low temperatures and relatively high dilutions of antiseptics, while the degrees of temperature and the concentrations of chemical antiseptics which are required to kill spore forming organisms approach closely to those which alter the physical properties of catgut and render it useless for surgical purposes. It is the spore forming organisms which are most likely to survive any so-called "sterilizing process" which aims at the destruction of bacteria while preserving the desirable physical properties of catgut. This study, therefore, concerns itself solely with the pathogenic spore forming anaerobes in raw catgut.

METHODS EMPLOYED

1. *Anaerobic conditions.* Adequate anaerobiosis was obtained by the use of a modification of the McIntosh and Fildes anaerobic jar (6) which utilizes the direct reduction of oxygen by hydrogen gas. This jar permits both mass culture in fluids and colony culture on plates, and the method is therefore preferable to test tube cultures with vaseline or other seal.

2. *Media.* For surface colonies, 10 per cent sheep's blood agar in Petri plates was used. Fluid media consisted in a modification of Holman's (3) cooked meat medium containing salt and peptone, with or without 0.2 per cent dextrose. For fermentation tests, 1 per cent dextrose, lactose, saccharose, salicin and mannite, and 2 per cent glycerine were employed. Litmus milk and Loeffler's serum medium served to indicate proteolysis. The media were adjusted to p.H. 7.4—7.6 with certain variations for special purposes.

3. *Material.* Specimens of raw catgut were obtained from several of the manufacturing firms. One of them obtained samples from various sections of the United States and Europe. Upon its arrival in the laboratory, the container was opened with sterile precautions in a "dust proof" room in order to obviate laboratory contaminations. The catgut was then placed in sterile test tubes and sealed.

4. *Inoculations.* Meat medium was used for the primary cultures. Several strands of catgut were transferred from their sealed tubes to duplicate tubes of meat medium. One set was then incubated in the anaerobic jar for 24 hours. The other set was left in the incubator without opening the jar for 7 days.

5. *Isolation of species.* After incubation for 1 or for 7 days, 0.5 cubic centimeters of the culture was transferred to each of three fresh test tubes of media. These were then heated in water baths for 15 minutes, at 70 degrees C., 80 degrees C., and 90 degrees C., respectively. The heated cultures were incubated and later plated. Colonies were then fished and replated until pure strains were procured.

6. *Determination of pathogenicity.* The original heated cultures (which generally contained several species of spore forming organisms), as well as the pure cultures, were used for inoculation in both mice and guinea pigs. Usually 0.5 cubic centimeter was injected into the muscles of the back or thigh. All animals which died were autopsied and cultures made from the tissues at the site of injection, from the peritoneum and from the heart. If mixed cultures were obtained they were purified by repeated fishing and plating.

7. *The classification of pathogenic strains.* This was finally accomplished by (a) studying the morphology of plate and fluid cultures, (b) observing the lesion produced in animals by whole cultures, centrifuged supernatant fluids and filtrates, (c) analyzing the behavior of the strain in fermentation tubes with various carbohydrates, (d) neutralizing the lethal action of centrifuged supernatant fluids and culture filtrates with known antitoxic sera.

RESULTS

Eighty-three specimens of raw catgut furnished by six different supply houses were examined as completely as possible for pathogenic spore forming anaerobes. Some of these specimens had come from the stock yards within 2 or 3 weeks; others were at least 2 years old. There was no apparent difference between these two groups. Of the 83 specimens, 45 yielded no pathogenic spore forming anaerobes. In the other 38 specimens, 42 pathogenic spore formers were found, 4 of the specimens yielding two different species. There were 28 strains of hæmolytic clostridium welchii (bacillus aerogenes capsulatus of Welch), 11 strains of non-hæmolytic clostridium welchii, 2 strains of clostridium novyi (bacillus œdematiens) and one strain of clostridium œdematis maligni (vibrion septique).

We did not find clostridium œdematoides (bacillus sordellii), clostridium histolyticum, clostridium tetani, nor any virulent clostridium sporogenes. We therefore took 38 more specimens and searched solely for these organisms but could not find them. Four cultures showed round end spores but were not toxin formers either in pure or in mixed cultures.

Two of the mixed cultures produced necrosis of skin and subcutaneous tissue without death of the animal. When the organisms contained in this mixture were isolated and injected in pure culture they did not have this effect. These mixtures did not include clostridium histolyticum and the necrotic lesion did not resemble the lesion produced by clostridium histolyticum.

Six of the mixed cultures which failed to kill in the usual dosage were concentrated by centrifuging so that 8 cubic centimeters was reduced to 0.5 cubic centimeter. This thick suspension was then injected in the usual way. Two of these six cultures produced death, but when these mixtures were separated, pure cultures of the organisms contained in the mixture, concentrated in the same way, failed to kill.

Only one of the cultures incubated for 7 days yielded a pathogenic organism which was not recovered from the 24 hour culture. This proved to be clostridium novyi (bacillus œdematiens).

Three of the seven day mixed cultures produced almost instantaneous death when injected either as a whole culture or as a centrifuged supernatant fluid. When the organisms contained in this lethal mixture were isolated and injected in pure culture they produced no visable affect whatsoever.

Almost all of the animals which died following injection succumbed in 24 hours. A few strains of bacillus welchii killed in 48 hours. When 0.5 cubic centimeter of a culture killed a mouse, the same dose was sufficient to kill a guinea pig.

Three strains which morphologically and culturally resembled vibrion septique were found which were not pathogenic.

The pure strains of pathogenic spore forming anaerobes found in these specimens of raw catgut have been studied to determine the optimum medium forgrowth, the optimum hydrogen-ion concentration, and the optimum degree of anaerobiosis. The anaerobic jar and the cooked meat medium are not ideal for large numbers of tests such as would have to be done by a large catgut firm. A clear medium with a vaseline seal is to be preferred. The results of this phase of the study will be published in the final report.

At first glance one is perhaps surprised that less than half of the specimens contained pathogenic spore forming anaerobes and that all of the known species were not found. It should be remembered, however, that we are dealing with the upper third of the intestine. It is well known that this contains fewer organisms than the lower portions. Aerobes were present in all of the specimens. We frequently found those heat resistant streptococci which will survive 70 degrees C. for 15 minutes. Non-pathogenic heat resistant spore formers were present in almost all of the specimens. It should be emphasized that we do not claim to have recovered all of the pathogenic anaerobes which were present in the catgut specimens. It is quite probable that in mixed cultures pathogenic strains were inhibited or overgrown by the non-pathogenic strains and in plating they may have been invisible as separate colonies. At times single colonies transplanted to other plates or to broth failed to grow. This is a fairly common thing with such strict anaerobes as clostridium novyi (bacillus œdematiens). It is possible that a few pathogenic anaerobes were lost on that account.

It is not surprising that clostridium welchii so far outnumbered the other pathogenic anaerobes. This is consistent with the general distribution of the organism and the usual proportion of these different species in cases of gas gangrene.

The absence of true tetanus bacilli was of interest. Although after prolonged incubation four cultures yielded round end spores, they did not make toxin. Ten Broeck and Bauer (9) in their study of the incidence of tetanus in the stools of Chinese patients, brought out the fact that in mixed culture the tetanus bacillus often does not produce toxin. They also state that in a large series of cultures containing organisms resembling tetanus bacilli, only one failed to yield toxin when the strain was purified. We are confident that we purified our cultures and still failed to find any true tetanus bacilli. This does not mean that this organism or any of the other anaerobes which we failed to find were certainly absent in the specimens or would be absent from another hundred specimens.

We consider it to be of unusual interest and significance that mixed cultures produced certain effects such as necrosis of skin, sudden death or gradual death, while the individual species comprising the mixture were non-pathogenic in pure culture. We believe that this illustrates the general principle of the adjuvant effects of species in symbiosis, sometimes called synergism, which has been demonstrated in a number of ways (1, 2, 4, 8).

The appearance of a pathogenic anaerobe (clostridium novyi) in the 7 day culture which failed to appear in 24 hours shows the necessity for prolonged incubation. Any test which is devised to determine the sterility of catgut which has gone through some sterilizing process must take this into account.

SUMMARY

1. Eighty-three specimens of raw surgical catgut have been studied to determine the presence of pathogenic anaerobes. Thirty-eight of these specimens were found to contain these organisms.

2. The 38 positive specimens yielded 42 strains of pathogenic spore forming anaerobes comprising all of the three common species of gas gangrene organisms. There were 28 strains of hæmolytic clostridium welchii, 11 strains of non-hæmolytic clostridium welchii, 2 strains of clostridium novyi, and 1 strain of clostridium œdematis maligni.

3. Thirty-eight other specimens were examined specifically for the other known pathogenic spore forming anaerobes, namely: clostridium tetani, clostridium œdematoides (bacillus sordelli) and clostridium histolyticum, but these species were not found.

4. Certain of the non-pathogenic species of organisms produced destructive lesions or lethal effects when injected in mixed culture which they could not produce in pure culture, thus illustrating the general principle of symbiosis or synergism.

5. Prolonged incubation for 7 days brought to light a pathogenic anaerobe which did not appear in the 24 hour culture.

CONCLUSIONS

In considering any sterilizing process to be applied to catgut, it must be assumed that any or all of the well known gas gangrene spore forming anaerobes are present in the material.

Any test to determine the sterility of the final product after it has passed through the sterilizing process must be able to bring to light any organism which may be present. The media and the method must be favorable to cultivate those anaerobes

which require the strictest anaerobic environment, and sufficiently long incubation time must be given for them to make themselves manifest.

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Discussion of Papers By Irving J. Walker and Frank L. Meleney

Dr. Sumner L. Koch, Chicago: It is a privilege to be asked to discuss the papers to which you have just listened. The effort to prevent contamination of surgical wounds by preventing bacteria from passing from the noses and throats of those in the operating room into open wounds, and the attempt to render surgical catgut absolutely sterile command the interest and deserve the co-operation of everyone concerned with the practice of surgery.

Some few years ago Dr. Meleney[1] was able to follow the course of a series of postoperative wound infections and to identify the causative streptococcus as identical with a strain obtained from the nose of one of the operating room nurses. He showed further that 33 per cent of the operating room staff harbored hæmolytic streptococci in their throats, and, subsequently,[2] that there is a seasonal rise in the incidence of streptococci in the throats of healthy individuals which reaches its height in the later winter months and recedes with the approach of summer.

That there are fatalities occurring every year from streptococcus infections due to contamination of surgical wounds in the operating room, none of us doubts. In 1916 I saw two such cases which made an ineffaceable impression on my memory. One patient was a young woman, 22 years of age, with a hæmolytic icterus. Her father had had a hæmolytic icterus of years' duration and had been cured by splenectomy. Because of the successful result in the case of the father a similar operation was performed upon the daughter, early in March, 1916. Eighteen hours after operation at four o'clock in the morning, I was called to see the patient; she had a temperature of 104.6 degrees, a pulse of 160, and was becoming delirious. She was given fluids intravenously, heart stimulants and repeated cool sponges, but she died 48 hours after operation. Autopsy showed a generalized peritonitis, due to a virulent hæmolytic streptococcus.

[1] Surg., Gynec. & Obst., 1926, xliii, 338.
[2] J. Am. M. Ass., 1927, lxxxviii, 1392.

A week later a man with an exophthalmic goiter was operated upon. Bilateral ligation of the superior thyroid arteries was performed under nitrous oxide anæsthesia. Within 48 hours he was dead from a hæmolytic streptococcus infection.

No more operations were performed on our service for three weeks. On April first the internes changed services. Almost within a week a death from peritonitis occurred on the gynecological service 48 hours after operation on a clean case. Looking back over this series of events, we remembered that the senior interne on our service had been in bed during the last week in February with an acute tonsillitis. He was very anxious to get back to work and assisted in the first two cases mentioned. April first he was transferred to the gynecological service and death occurred in one of the first cases in which he assisted. He was then sent away from the hospital for 6 weeks and no more similar catastrophes occurred.

Doubtless similar cases have occurred and are occurring elsewhere. Rarely are they reported or traced to their source. Of eminent practical importance is the fact stated by Dr. Meleny in the paper quoted above that after the noses and throats of all the operating room personnel were masked there were no more hæmolytic streptococcus infections in clean cases. The mask which Dr. Walker has described is, he feels, the most satisfactory it has been possible to devise. We owe it to our patients and ourselves to give it a thorough trial.

Of equal importance to protecting patients from infection from carriers of pathogenic organisms is it to assure the sterility of catgut. You are familiar with the report of Dr. Meleny upon a small group of cases of wound infection due to an unusual type of gas producing organism found in the catgut used.

Two years ago a woman of 50 on our service was operated on for hyperthyroidism. On the fifth postoperative day she complained of a headache.

Aspirin and pyramidon were given, but the headache persisted and she began to complain of difficulty in swallowing. We were concerned, but thought that inflammatory reaction about the œsophagus might explain the symptoms. The same evening she complained of tingling of the hands. One of our best medical men examined her carefully. The question of tetanus was brought up, but we concluded that she was probably suffering from a mild tetany, and began administration of calcium and parathyroid extract. The following morning she developed for the first time difficulty in opening her mouth, and immediately antitetanic serum was given intraspinally and intravenously. In spite of the serum, the patient rapidly became worse and died within 24 hours with the characteristic symptoms of tetanus infection. I have seen two other cases that developed the clinical picture of tetanus, one 12 days after a herniotomy, the other 3 weeks after a pelvic operation; fortunately both of them recovered. It is not necessary to say that any effort which promises to make impossible surgical tragedies of this type deserves our whole hearted admiration and support.

We are greatly indebted to Dr. Walker and Dr. Meleney for the work they have done. It is a fortunate circumstance that men who possess the essential combination of an extensive experience in clinical surgery and years of training in bacteriology are devoting themselves to the solution of these problems.

It is also a matter of congratulation that the College of Surgeons is having a part in this work—not simply because we as members of the College have a personal interest in its activities, but because it is always a matter of congratulation when a body of individuals, united for the common good, can by education, by example, and by moral force help to bring about far reaching improvements such as Dr. Meleney has indicated the manufacturers of catgut are voluntarily about to undertake.

EDITORIALS

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JANUARY, 1930

NINETEENTH ANNUAL CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

CHICAGO had not been host to the Clinical Congress since 1923 and every effort was exerted to make this year's meeting a homecoming event that would long be remembered. The Chicago Committee on Arrangements took advantage of its opportunity to utilize the extensive clinical facilities of the city and a widely varied and extremely interesting program was the result. More than three thousand surgeons from all parts of the United States, Canada, and foreign lands spent 5 busy days attending the numerous clinics and demonstrations. The evenings between the Presidential Meeting on Monday and the Convocation on Friday were taken up with excellent, well planned scientific meetings.

The program of clinics prepared by the subcommittee on surgery of the eye, ear, nose, and throat was all that could be desired and the attendance at these clinics indicated the great interest in these surgical specialties. On Wednesday evening, October 16, a dinner meeting for this group was held at the Hotel Stevens with Mr. Herbert Tilley of London as the principal speaker.

The progress of the medical motion picture department of the College was clearly shown by the exhibition of films that have been completed under the supervision of, and have been approved by, the Board on Medical Motion Picture Films. In addition to the films produced under supervision of the College, a number of other films of unusual merit or interest were shown, including several reels of colored film and four talking films.

The annual hospital conference proved to be another outstanding feature of the Congress. Emphasis was placed upon "the care of the patient" in this year's conference and a series of interesting and instructive demonstrations, papers, and round table conferences was included in the program. An added feature of the hospital program was the joint session held with the Association of Record Librarians of North America. This organization was formed last year at the Congress in Boston and has already proved itself an aid in overcoming the difficulties all hospitals have in trying to improve their records.

The entire day of October 18 was spent on the discussion of traumatic surgery. An open forum and symposium were held in which representatives of labor, indemnity organizations, industrial concerns, and surgeons interested in that phase of surgery participated. A gratifying amount of interest was shown in this conference.

Reports of officers and standing committees of the College were presented at the annual meeting of the Governors and Fellows held on

October 17. In addition to the reports, officers were elected for the ensuing year. Following the annual meeting a symposium on cancer was presented.

The various committees and boards of the College held meetings, reported on progress made, and discussed plans for furthering the work in 1930.

At the Convocation on Friday evening, October 18, the 1929 class of Candidates for Fellowship was admitted to the College. This group numbered 669.

Distinguished members of the surgical profession from other lands were in attendance at the Chicago Clinical Congress. Some came to participate in the program of the Congress and others were spectators. Among these visitors from abroad were the following: Florestan Aguilar, El Vizconde de Casa Aguilar, M.D., Madrid, Spain; Harry Harris, M.D., Ch.M., F.C.S.A., Sydney, Australia; James Heyman, M.D., Stockholm, Sweden; J. Newman Morris, B.S., M.B., F.A.C.S., Melbourne, Australia; W. A. Osborne, M.B., B.Ch., D.Sc., Melbourne, Australia; Herbert Tilley, M.D., B.S., F.R.C.S.(Eng.), London, England; Henry S. Wellcome, LL.D., F.S.A., London, England; Daniel M. Velez, M.D., F.A.C.S., Mexico City, Mexico; and D. P. D. Wilkie, M.B., Ch.B., M.D., F.R.C.S. (Eng. and Edin.), M.Ch., F.R.S.(Edin.), F.A.C.S., Edinburgh, Scotland. Honorary Fellowships were conferred upon Florestan Aguilar, James Heyman, and W. A. Osborne.

DAVID C. MACKIE.

THE SCIENTIFIC PROGRAMS

A BRIEF survey of the scientific programs of the recent Clinical Congress discloses a number of interesting facts: a large part of one of the four evening sessions was devoted to a subject—pernicious anæmia—ordinarily considered as of interest only to medical men; four papers—Archibald's Walters', Walker's, and Meleney's, were devoted essentially to the question of placing greater safeguards about surgical patients and rendering surgical procedures less hazardous. Only two papers—Holden's and Harris'—were primarily concerned with the question of surgical treatment; only one paper—Adson and Rowntree's—was devoted to the presentation of a newly developed method of surgical treatment, and this paper was discussed, not by surgeons, but by a neurologist and a neuro-anatomist; of thirteen others who took part in the discussion of the papers presented, two were physiologists and one a specialist in internal medicine. These facts seem to us to indicate the means by which American surgery is attempting to advance—by seeking closer contact with the departments of internal medicine, of physiology, of anatomy and bio-chemistry; by turning to the experimental laboratory, as Dragstedt emphasized in his discussion upon intestinal obstruction; by asking the bacteriologist to help find the sources of wound infection and to devise means of making catgut absolutely sterile.

That American surgery continually holds out its hands across the seas and says "Come over and help us," and that the response is always a generous one is evidenced by the roll of distinguished surgeons from the Continent, from Britain, and from the British Commonwealths that have contributed so largely to the Clinical Congresses of this and of former years. The Murphy Oration of Professor Wilkie and the paper of Dr. Heyman upon the treatment of cancer of the pelvic organs were highlights in a series of interesting and stimulating programs. Those who had the privilege of hearing them will appreciate still more in the quiet of the library

the rich wisdom of Wilkie's paper and the impressive results that are being obtained in the treatment of pelvic cancer by Heyman and his associates at the Radiumhemmet.

SUMNER L. KOCH.

THE CLINICS OF THE CONGRESS

IN no other profession do the members display such gregarious tendencies as do those in medicine and surgery. It is rightly so, since the education of the doctor is a life-long business. The problems of disease are complicated, difficult, individual, and uncertain. The lawyer has the forms, procedures, and precedent of laws which have been laid down during the years. The minister, once having grasped the certainties of divinity, may settle himself into a life of delight and pleasure.

Our medical schools see to the educational requirements of the medical student but the further education of the doctor is self-imposed. No other method of medical graduate education is so widely employed as that of attendance upon medical gatherings of one sort or another. We may read of a newly discovered scientific fact, or an improved bit of surgical technique, but the interest so aroused is not comparable to that awakened when the same fact is given to us as a personal offering.

It is not difficult then to understand why the clinics given during the week's meeting of the Clinical Congress of the American College of Surgeons have met with such success from the time of the first meeting in 1913. During such clinics each year some three to four thousand surgeons are given the opportunity to see their colleagues at work in their various hospital and medical school homes throughout the country. There is a stimulation of interests and there is an exchange of ideas and methods which are of mutual advantage. The individual patient and, therefore, the public are the ultimate recipients of the benefits of such clinical gatherings.

The clinics given by the members of the medical profession of Chicago during the recent Congress maintained the high standards which had been set in previous years by men in other cities. Every field of interest in surgery was represented in these clinics. The attendance was large and, as usual, efficiently distributed by the management of the Congress. This is worthy of more than passing notice, when it is realized that the choice of attendance upon a given clinic rests with each individual surgeon who attends.

The enthusiasm to make these clinics successful which was shown by the doctors of Chicago, many of whose interests lie outside of surgery, is a tribute to the spirit of progress in that continuous march of self-education which is the outstanding characteristic of the medical profession.

LOYAL DAVIS.

THE HOSPITAL AND SURGICAL PRACTICE

THE trend of medical practice today is very clearly shown by the relationship existing between the medical profession and the hospitals. Having developed through the past years into the present admirable institutions so highly professional in character, hospitals have attained a position of great importance. They are no longer mere shelters or asylums or even workshops but are functioning factors of significance in the care of the sick and injured and must be accorded that place in the practice of the art of medicine. Great responsibility is now given to the various hospital workers, whose education and training in specific scientific fields have earned the confidence and esteem of the medical profession. Today, the physicians and the hos-

pital personnel labor side by side as associates even though the former directs and bears the major responsibility.

The American College of Surgeons for several years has recognized this co-ordination of effort by arranging and providing for Hospital Standardization Conferences in conjunction with the meeting of the Clinical Congress. The programs are formal and informal, and surgeons, hospital authorities, nurses, and others contribute to discussions of mutual problems. These conferences are unique, outstanding, and significant, since they offer opportunity for the surgeon and the hospital worker to exchange opinions and constructively to analyze future activities and determine procedures.

During the recent four day meeting, students of medical affairs were gratified by the earnest and intelligent presentations of valuable contributions by eminent surgeons and well known hospital representatives. Through formal papers, open forums, and general discussions many of the perplexing and unsolved problems received serious attention and helpful suggestions.

The opening session was devoted to a symposium on the timely subject of the cost of medical care. The comprehensive program included spokesmen of the several factors concerned and was productive of seasonable, pertinent comments and contributions of real worth pertaining to the subject. Some of the other topics of general interest presented were: the accrediting of surgical deaths; the lessening of surgical infections and complications due to errors in technique and the use of unsafe material; measures of efficiency and proper requirements for the ideal functioning of important hospital activities and departments. These and the other equally opportune themes discussed are indicative of the sane, methodical endeavor on the part of serious minded physicians and their hospital collaborators to meet their responsibilities. F. H. Slayton.

SEVENTEENTH CONVOCATION

THE seventeenth convocation of the American College of Surgeons was held the night of October 18, 1929, in the Grand Ballroom of the Hotel Stevens in Chicago, the beautiful appointments and dignified spaciousness of which made it a fit setting for such a ceremony. Blazing with lights and hung with flags, it was crowded to the doors and to the very edges of the galleries long before the candidates for fellowship, in the robes of the College, filed into their seats immediately below the platform.

Then to the strains of martial music the stately procession of College dignitaries and honored guests made its way down the central aisle to the seats on the stage. At their head a captain of the United States Army bore the Great Mace of the College, the gift of the consulting surgeons of the Armies of Great Britain, in token of undying friendship and in lasting memory of those days of trial when the two great English-speaking nations of the world fought shoulder to shoulder that freedom should not perish from the earth.

Then, in blue and scarlet gowns and caps, came the officers of the College: Dr. Franklin H. Martin, director general and past president, to whose inspired thought this noble organization owes its conception and existence; Surgeon General Merritte W. Ireland, president; Dr. C. Jeff Miller, president-elect; other officers and officers-elect, and members of the Board of Regents. After them came the candidates for honorary fellowship: Viscount Aguilar, of Madrid; Professor James Heyman, of Stockholm; and Professor William Alexander Osborne, of Melbourne; men of eminence, literally from the Antipodes, in honor-

ing whom the College has honored itself. Finally came the distinguished guests, representing many nations and many fields of endeavor but bound by a common bond of honorable achievement, and behind them were seated the Governors of the College.

After the playing of the music common to "God Save the King" and "My Country, 'Tis of Thee," the invocation was offered by Dr. John Timothy Stone. The Director General then presented 669 candidates, the majority of them present, who were formally received into fellowship by the President. The candidates for honorary fellowship were then presented by Dr. Irvin Abell, by Dr. Allen B. Kanavel of the Board of Regents and by Dr. C. Jeff Miller, president-elect. The "Presidential Address" by Surgeon-General Ireland and the "Fellowship Address" by Dr. Glenn Frank, president of the University of Wisconsin, together with the remarks of the Director General, will be found in full elsewhere in this volume (see pages 296, 302, 285 and 295). They speak for themselves. I cannot, however, refrain from commenting on their high level of excellence, or from commending to the particular attention of the Fellows of the College President Frank's admirable and well considered statement of the responsibility of the profession for the health of the nation and his grave warning that unless we set our own house in order, control of medicine by the state is the inevitable consequence.

The playing of "The Star-Spangled Banner" and the recessional march from the platform brought to a close the Convocation of 1929, and I, who have seen many Convocations of the American College of Surgeons, was stirred as I always am by what this organization is and what it stands for. Certainly there can be few ceremonies more beautiful to behold, more replete with significance, than this solemn ritual by which a great surgical brotherhood sets its seal of approval on the neophytes who have sought admission to its ranks. In its simple dignity, in its deep meaning, in its solemn pledge, in its note of consecration, it is a ceremony which touches alike the hearts of the new Fellows and of Fellows grown gray in its service and which reminds them anew of the sacredness of the task entrusted to the surgeons of America. C. JEFF MILLER.

PRESIDENTIAL MEETING AND CONVOCATION

ADDRESS OF WELCOME[1]

HERMAN L. KREVSCHMER, M.D., F.A.C.S., CHICAGO
Chairman, Chicago Committee on Arrangements

IT is indeed a great honor and a rare privilege to welcome you to Chicago to attend this the nineteenth annual meeting of the Clinical Congress of Surgeons of North America. This I do on the behalf of the College, its officers, and workers who have so faithfully and with a great deal of enthusiasm and much hard work arranged this meeting for you; and also on behalf of the men who will conduct the clinics during this week, as well as on behalf of the hospital authorities and personnel who have so generously and with such fine spirit co-operated in arranging the clinical part of the program.

The local men are delighted to have the opportunity of taking part in the program and to be given the privilege of seeing so many of you here, and the chance to renew old friendships and acquaintances.

It has been 6 years since the Congress met here. Since that meeting a great medical expansion has taken place. Some of the hospitals have built elaborate additions, others have replaced the old with new buildings, and many new hospitals have made their appearance. This hospital expansion allows us to boast of the largest hospital in the world, namely, Cook County Hospital with a total bed capacity of 3,300.

Beside these great strides in hospital development two new medical schools have been built and put into operation: the Medical School of the University of Chicago on the Midway and the splendid unit of the Northwestern University on the McKinlock Campus.

May I burden you for just a few moments to direct your attention to some of the other medical activities located here that have contributed so much toward the medical development of Chicago? This is the home of the American Medical Association, the largest medical society in the world, which publishes the *Journal of the American Medical Association*, having the largest circulation of any medical journal in the world.

The home of The American College of Surgeons is also located in Chicago. The great accomplishments of the College are directly due to the vision and stimulation of the founder, our present president. Its modest beginning stands in marked contrast to its manifold activities today and each year many new activities are undertaken.

The office of the largest surgical journal published in the world is located in Chicago, and we are all proud that this is the official journal of the Clinical Congress.

We can now boast of six great medical libraries; namely, the John Crerar, the Library of The American College of Surgeons, the splendid library of Rush Medical College, the Billings Library, Quine Library, and the Archibald Church Library.

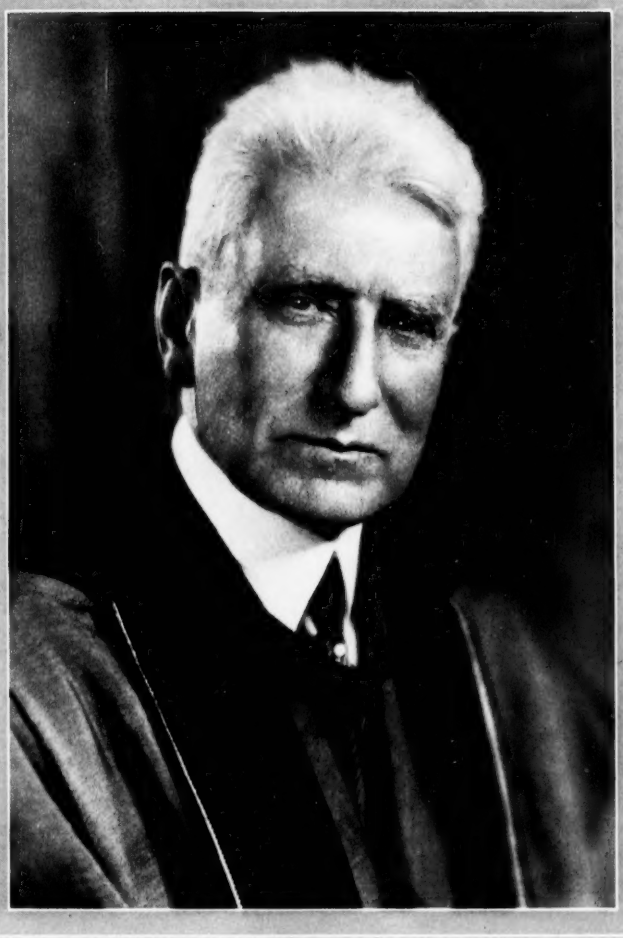
There are many other closely allied medical institutions: The home of the American Hospital Association is located here, and here are published two great journals dealing with hospitals; namely, The Modern Hospital and Hospital Management.

More and more as time goes on the close relationship between dentistry and medicine becomes apparent. We find here the greatest dental organization, the American Dental Association, which publishes the greatest dental journal in the world.

All of these facilities, ladies and gentlemen, we place at your disposal in the hope that your attendance at this Congress may be a profitable as well as an enjoyable one.

And finally, before closing, may I pay a brief tribute to those surgical pioneers who have done so much for American surgery, locally, nationally, and internationally? It seems to me that at this time it is only fitting that we do this. In passing, may I mention Senn, Murphy, Gunn, Isham, Fenger, Ochsner, Parks, Edmund Andrews, E. Wyllis Andrews, Graham, Ferguson.

[1]Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.



Franklin H. Martin

ADDRESS OF THE RETIRING PRESIDENT[1]

FRANKLIN H. MARTIN, M.D., F.A.C.S., CHICAGO

SURROUNDING me here are my associates with whom I have worked for twenty-four eventful years. For twenty-three years I acted as a sort of chief gardener in the cultivation of the soil; I did the footwork under their sympathetic guidance. Last year they honored me with the presidency of this organization.

A PARABLE

I.

In 1905, with Nicholas Senn, John B. Murphy, William J. Mayo, and George W. Crile, we selected a field and with seriousness sowed the seed upon it. It was a literary seed.

Our critics laughed, and asked: "How do you practicing surgeons expect to grow a successful crop of surgical journalism when real literary genius is reaping only a scant harvest?"

"That is the point!" we brusquely answered. "We are sowing a seed created from the yearnings of practical surgeons who not only write of surgery but who actually do it; and we hope to reap a magazine that will interest, inspire, and instruct other practical surgeons like ourselves."

So the gardener, stimulated by such encouragement, put hoes into the hands of loyal young diggers—Kanavel, Besley, Cubbins, Hollister, and Ballou—and an unexpected crop resulted. It was so lusty, so thriving, and so worth while that they gave it the euphonious name of SURGERY, GYNECOLOGY AND OBSTETRICS—fondly nicknamed by the vulgar "S. G. & O."

II.

Rapidly the crop developed into a grove of rugged trees. Each leaf of these trees represented a message from a practical surgeon. Each was a message to the head gardener which said: "Congratulations! Enlarge your garden. We are impressed with the practical *writings* of your editors. Let us see them in *action*."

So we planned the new field and hoed and watered; and lo! other helpers joined us: Ochsner, Cotton, Edward Martin, Brewer, Charles Mayo, Squier, Eagleson, Clark, Porter, Matas, and Lund, and the crop was overwhelming. The new apparition, when it came in 1910, was called the "Clinical Congress of Surgeons of North America."

This crop brought practical men into their own. They would now be shown. Each twig on the tree of practical literature brought with it another yearning brother, and there were *some crowds* in the great cities that received and welcomed the new idea.

III.

The soil that brings forth an abundance of wheat also attracts and develops tares and thistles. The gardener and his proud workers were becoming panic stricken. The fertile field, without exclusive walls, with the wind and the sunlight stimulating its crop, did not discriminate. The gardener and his aids pondered and declared that the obstructing weeds must be destroyed. The tares of ignorance and effrontery, and the thistles of unethical commercialism, must be torn up and cast aside.

A new sowing must be planned with a careful sifting of the seed. The work of years must be conserved inviolate. The ideals must be established in permanency.

The workers, trained in a common service during 8 long years, put their heads together and determinedly considered the existing facts. Many serious followers had become their willing aids. In the hopper of their conference they placed their practical accomplishments, their ideals of fair play and intellectual worth, and their many plans for conservation. The tried workers sharpened their weapons, re-examined their soil, segregated their seeds, and with their combined experience replanted. The unfenced field again brought forth, under the surveillance of these experienced laborers, a new, an abundant, and a pure-grade product. The sifting of the seed had accomplished much. It was realized that watchfulness of the growing crop was necessary if surreptitious tares and thistles were to be eliminated.

Thus in 1913 the gardener and his followers looked upon the crop, and it was good. They called it the "American College of Surgeons."

The conventionalists and the traditionalists critically observed this new crop, shrugged their shoulders, and complimented its creators by pronouncing it "too good to last."

England sent its distinguished President of the Royal College of Surgeons, Sir Rickman Godlee, the nephew of Lord Lister, to grace the first Convocation. He did not shrug his shoulders but looked upon the new venture with sympathy and approval.

[1]Presented before the Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

From behind the traditional walls of Princeton and Johns Hopkins came John Finney, the first President, who surveyed the open field and quietly took off his coat and labored.

Following Finney, Crile became our chief, and added to our store his research mind and his mechanistic theory. Then, behold, came William, who until that time had watched Charlie do the hoeing. *He was some cultivator himself.* He would show these amateurs! Off came his coat. He chose for *his* weapon a brand new axe. This for two long years he swung with vigor. Then came the giant of the North, Armstrong, who imparted dignity and loyalty; came Deaver, from Quaker town, with his pious gestures and his spectacular accomplishments! Reluctant Cushing, who thrice refused the crown as he critically surveyed from "precedent tower" of Harvard the unfenced field of "upstarts," finally succumbed to the persuasion of William and his axe, became a lamb, donned the crown, and was an interested worker.

Then came beloved Ochsner, with his battle-axe pledge against commercialism and bluster. He developed into the watch-dog of our growing treasury, acquired as no other man the ideals of the College; and after his labors was laid to rest, at his own bidding, in the presidential robe of the American College of Surgeons. Wise and faithful Charlie was promoted from the ranks, followed by the pride of Dixie, Matas, who told us all about it; Chipman with his wisdom and eloquence; and then George Stewart, the wise Scot from Manhattan, who charmed us with his wit and instructed us with his maxims of common sense.

The consulting surgeons of the Armies of Great Britain sent Sir Berkeley Moynihan to us with a golden mace, an ancient club of authority, which added a touch of tradition to our brand-newness.

And so our field has grown, and our jurisdiction has extended. At first Canada and the United States. How lucky that we fixed no boundary and that we did not exclude! Mexico, Central and South America are now among our workers. Australia and New Zealand applauded, asked for our co-operation, and complimented by imitating us.

The Presidents of the Royal Colleges of England, of Ireland, and of Scotland have honored us by becoming our Fellows and have commended our progressive organization. Our fellowships are valued not only in the British Isles, but in France, Spain, Italy, Norway, Sweden, Denmark, Holland, Belgium, Switzerland, India, China, Japan, and Africa.

Thus readeth the parable.

Then Why the American College of Surgeons?

There was need for a comprehensive, democratic association of surgeons and surgical specialists; an assocation or guild to which all practical surgeons could aspire for fellowship; where moral and spiritual ideals could be openly discussed and affirmed; where education and professional ability would outrank effrontery, commercial trickery, and social prestige.

Brave men risked the questioning and resistance of the conventionalists, and organized. Their earnestness and industry inspired thousands of others who had been waiting for a sign and who wondered why someone had not thought of it before.

The organizers realized that there was no need for another mere medical society. Their aim was an association which would embody their aspirations; a movement with dynamic proclivities, and character enough to influence the recognition and acceptance of practical ideals.

"What then," these pioneers said, "is our paramount business? How are we to begin? There must be no disposition to duplicate the work of others. There must be co-operation with all the profession in the lines of betterment. Our special leadership must be confined to neglected problems and paramount reforms."

First, back the cultivation of professional attributes. Emphasize these qualities rather than the commercial, specifically the buying of patients by commission-giving, the unprofessional evil known as fee-splitting which the College, with troublesome frankness, vigorously denounces.

Second, fix a standard for fellowship that will give proof of surgical proficiency, viz., proof of actual specialization in surgery for 8 years or more; an examination that will prove the quality of work through records of cases to be filed as evidence of actual operations; approval of moral and professional qualifications by a committee of peers in the applicant's own state, backed by written references; evidence that he is a legalized practitioner, a graduate in medicine with the degree of M.D.; a member of his local and the national associations of scientific medicine; and require of each and every applicant a definite, signed declaration against the division of fees.

Third, frankly endeavor to increase pre-operative diagnostic efficiency, which would lessen unnecessary operating and make necessary operating more safe and effective.

Fourth, standardize the hospitals and the laboratories—in a word, the environment or workshop in which surgery is performed.

Fifth, conduct a practical research into the records and treatment of cancer—the clinic and hospital services of our nine thousand Fellows, and our two thousand accepted hospitals to be used as an amplified laboratory from which the consensus of experience and opinion may be gathered, and a yearly pronouncement formulated as to the best treatment for this dread disease.

Sixth, aid industry to perfect an organization to standardize its medical methods, and to provide medical and surgical care to sick and particularly to injured employees in such a manner as to insure efficient work by the surgeon, to earn the approval of officials of labor, to meet the requirements of indemnity laws, and to warrant satisfaction in the underlying industries.

Seventh, promote the Clinical Congress, the first large organized society of clinical surgeons and the forerunner of the College; and continue to provide through the Congress clinical meetings in the large cities at which the attending surgeons may witness practical demonstrations in surgery and observe the actual technique of operations.

This then gives a bird's-eye view of your organization, the American College of Surgeons. Ours is a practical program. Through the judicious management of our funds we have enlisted the support of our large fellowship who themselves finance our progressive activities with a yearly budget that has varied during the years until now it approximates two hundred thousand dollars.

The citizens of Chicago and the local Fellows gave to the College its headquarters in this city; the friends and family of Dr. John B. Murphy built and gave to the College the Murphy Memorial Hall and Library; and the College has recently financed the purchase of an additional one-quarter block which adjoins the present home and on which will be built our Clinical Research Museum.

The program of the College, in its varied activities, has been accorded enthusiastic reception. Our strict requirements for Fellowship—with the elaborate machinery of educational and professional references, state committees on credentials, and the final test of case records—are looked upon as professional hurdles that every aspiring surgeon should be able to negotiate successfully.

The program of hospital betterment which has been accepted by the hospital world of this continent, creates a tragedy for the institution that does not meet the requirements of the Minimum Standard of the College. The profession requires the standard, the people have learned to look for the certificate of approval, the university medical schools make it their requirement for the assignment of internes, and the government hospitals have recognized the College's survey and require its approval.

For 9 years the College has carried on research in the treatment of cancer (carcinoma and sarcoma). Its findings represent the work of hundreds of our members who report their cases to the heads of our two committees. These valuable findings are becoming more and more valuable as successive five-year cures are recorded. Two years ago, at the Conference of the British Empire Cancer Campaign, in London, every address which dealt with sarcoma spoke of the College's Registry. Its comprehensive archives of cancer will make its work of lasting importance. The Committee on the Treatment of Bone Fractures has an important place in the Clinical Research Department. It was the outgrowth of the stimulus given to this important subject by the treatment of fractures in the World War.

Time will not permit me to dwell on the other important activities represented by our departments of Literary Research, Motion Pictures for Medical Teaching, the Standardization of Hospital Equipment and Instruments, and the far-reaching importance of our publications, including the official journal, SURGERY, GYNECOLOGY AND OBSTETRICS.

When questionings arise, when criticisms threaten, when the gossipers embarrass, when our ideals are ridiculed, remember that we are but 9,000 in comparison with 160,000.

Remember that the tree with the most desirable fruit has beneath it the largest number of missiles.

Remember, too, that the rank and file of us have the same responsibility in maintaining our ideals and standing as do those wheel horses who have borne the brunt of the fray from our earliest days.

From a small beginning we have built in a few years an institution of worth, whose reputation has gone far and whose influence has extended to laymen and to the profession alike. Reputation will not last unless worth and influence are behind it. The development of academic complacency will soon displace strong convictions and thrift and enterprise if the wise among us are not constantly wakeful to its insinuations and if we do not have the courage to stamp out its earliest appearance. This will require constant thoughtfulness as well as watchfulness.

These fundamental principles are observed with religious enthusiasm by your inner group of associate administrators, who as your working understudies conscientiously, year by year, have carried out our intricate program. You have known each

one of them. Without the loyalty and thoughtful industry of such a group there could not have been a College of Surgeons. Ballou, Farrow, Bowman, MacEachern, Craig, Salisbury, Carr, Leigh, Myers, Ulrich, Spencer, Perry, Walker, Williamson, Crowell, and Grimm are names that deserve not only praise but permanent monuments.

Fellows of the College, I thank you for allowing me to stand here as your President. With your kind sufferance, when I retire from this position, I will return to *my* garden and *your* garden and work the best I can with the old implements and endeavor to practice what I preach.

PEACE JUBILEE

Mr. Surgeon General: May I remind this audience that 11 years ago 90 per cent of the Fellows of the American College of Surgeons enrolled for war service—40 per cent in the Medical Corps of the United States and Canadian Armies, 10 per cent in the Navy Medical Corps, and 40 per cent in the Volunteer Medical Service Corps of the United States, for emergency service in either the Army, Navy, or Public Health Service.

May I remind this audience that the Fellows of this College organized the Committee of American Physicians for Medical Preparedness 18 months before the United States entered the World War, and the services of this Committee were recognized and accepted by President Wilson and Secretary Baker exactly one year before we entered the war.

May I remind this audience that it was the Fellows of this College who were at the head of the greater percentage of the 42 Base Hospitals that were organized in the United States by Colonel Jefferson R. Kean for service overseas. Several of these Base Hospitals reached England and France before any other American soldiers. Conspicuous among them were George W. Crile, Harvey Cushing, Frederic A. Besley, Angus McLean, Dean Lewis, George E. Brewer, A. J. Ochsner, L. L. McArthur, Charles H. Peck, John M. T. Finney, Fred T. Murphy, C. A. Evans, Arthur A. Law, J. F. Binnie, Stuart McGuire, J. B. Eagleson, Edward L. Keyes, C. L. Gibson, R. H. Harte, Fred Kammerer, M. Clinton, Edmund D. Clark, W. A. Elting, A. P. C. Ashhurst, J. J. A. Van Kaathoven, Burt R. Shurly, Edwin H. Fiske, William F. Wesselhoeft, R. T. Miller, David Barrow, William H. Goodwin, E. C. Davis, William Gillespie, Charles Levison, William Francis Honan, A. C. Stokes, and Samuel Lloyd.

I hope that it is not amiss to state in the presence of our incoming president—a warrior by profession but a peace advocate by nature—in this the Jubilee Year of peace, with Presidents, Premiers, Secretaries of State, and Ambassadors straining at their leashes in their efforts to make war a misdemeanor and peace permanent, that these efforts are welcomed by this organization that took a leading part in the prosecution of the World War.

May I read an excerpt from a letter written by our great United States War Secretary, Newton D. Baker, who, as you will see, appreciated our work in aiding his great task:

> "Perhaps because I was the son of a doctor and came as near studying medicine as it was possible to do and still miss it, I had especial interest in the work of the medical corps during the World War. Nobody could have been in close contact with Gorgas without realizing his gentle greatness and, as he gathered about him the most devoted and eminent members of the profession, I felt that I was admitted to the inner sanctum and permitted to see the optimism and inspiration which characterizes the great medical profession in these days of magnificent progress.
>
> "I would like to have had a chance to say some of the things that are in my mind and heart about doctors generally, but as it is I must resist the temptation and merely express to you the deep appreciation I feel for the honor which your invitation does me."

The gavel. This, our gavel, was devised and used by Lord Lister and was presented to the American College of Surgeons by Sir Rickman Godlee, then president of the Royal College of Surgeons of England, in memory of his visit to Chicago, November, 1913.

The Great Mace. The Great Mace was presented to the American College of Surgeons by Sir Berkeley Moynihan (now Lord Moynihan) in 1920. It is the gift of the Consulting Surgeons of the British Armies to their confrères in Canada and the United States.

SURGERY IN THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY[1]

MERRITTE W. IRELAND, MAJOR GENERAL M.C., U.S.A., D.S.M., F.A.C.S., WASHINGTON
Surgeon General, United States Army

DURING the Revolution surgery was in a relatively primitive state, as were medical education and practice in general. John S. Billings stated in 1876 that the total number of medical men in America with a medical degree was about 200 in 1776, the number with a liberal education not over 350. These were the educated physicians who looked after the medical needs of some three million people and who, incidentally, took a prominent and important part in the public life and the politics of the country. Five of the 56 signers of the Declaration of Independence were medical men, as were 23 members of the Massachusetts Provincial Congress in 1774–1775.

There were, of course, more than 250 men practicing medicine. It has been estimated that there were 3,500, but most of them had no degrees, nor more medical education than they had derived from a preceptorship. Such a man was Isaac Senter, the surgeon with Arnold's expedition to Quebec, yet he later attained great prominence in the profession and honorary membership in the medico-chirurgical societies of Edinburgh and of London and in the Massachusetts Medical Society. Such also was John Cochrane, who became the head of the Medical Department of the Army in 1781. Some surgeons and mates were mere boys, a few in their teens. Doubtless many men had no qualifications other than a desire to practice and a few rules of thumb.

It was the custom to study medicine with a preceptor . . . . "A custom necessary at that time, because of the scarcity of institutions of learning and the expense connected with an education. The form of apprenticeship was often gone through with for a term of years varying from 3 to 7, during which time the young student performed the most menial duties, had very meagre opportunity for anatomical study, and acquired his knowledge rather by contact with and absorption from his preceptor than in any other way." The preceptor usually had also a small library, a few odd bones, occasionally an entire skeleton. These the student could use. His clinical experience came from witnessing and at times assisting in office practice. There he learned to bleed, to pull teeth, to open an abscess, to blister, to give an emetic, to help reduce a dislocation, set a fracture, or dress a wound. Later he accompanied his preceptor to see patients in bed.

Let us not forget, however, that the army had the benefit of the best surgical knowledge that the country afforded. Such men as Morgan, Shippen, Warren, and Rush were in the service.

There were but two medical schools in the country; one in Philadelphia and one in New York.

"At the commencement of the Revolutionary War we had one medical book by an American author, three reprints, and about twenty pamphlets. The book referred to is the *Plain, Precise, Practical Remarks on the Treatment of Wounds and Fractures* by Dr. John Jones, New York, 1775. It is simply a compilation from Ranby, Pott, and others, and contains but one original observation, viz., a case of trephining followed by hernia cerebri."[2] This book, containing 114 pages, 4½ by 7½ inches, is usually found bound with *The Diseases Incident to Armies with the Method of Cure*, etc., a translation from Van Swieten of 164 pages of the same size.

John Jones was professor of surgery in King's College. He had been a surgeon in the French and Indian War and was for a short time in the Medical Department during the Revolution.

These books constituted the library of the average American army surgeon of the day. In addition Cullen's *Lectures on Materia Medica* had been issued in Philadelphia in 1775. The more learned and wealthy physicians also had works published in Europe, but the two books shown were the standard.

Of the books upon which John Jones based his compilation Ranby's was a 96 page booklet on gunshot wounds written in 1760, while Pott's large volume of *Chirurgical Works* dealt only with wounds of the head, fractures and dislocations, lachrymal fistula, fistula *in ano*, hydrocele, and hernia. Pott argued for the use, in treatment of fractures, of splints extending beyond the nearest joints and against the then too prevalent practice of using those only a few inches long and serving only to make pressure.

Medicine and surgery were not separate professions as in Europe. The small number of doctors in the sparsely settled country made it

[2] Billings. Century of American Medicine.

[1] Inaugural address, Clinical Congress of the American College of Surgeons, October 14–18, 1929.

necessary that each be a general practitioner. Thus Benjamin Rush was successively surgeon general and physician general in the Central Department. A century later, in 1876, Samuel Gross wrote: "It is safe to affirm that there is not a medical man on this continent who devotes himself exclusively to the practice of surgery. On the other hand, there are few physicians, even in our larger cities, who do not treat the more common surgical diseases, such as fractures, dislocations, and wounds, or who do not even occasionally perform the more common surgical operations."

This rather long introduction is by way of preparation and explanation for the fact that the surgery of the Revolutionary War was not great, although it must have been greater than the record left of it. There were, of course, other reasons why it was resorted to only in cases of dire necessity, chief of them being the absence of anæsthesia, the danger of injury to vessels and nerves, and the practical certainty of infection, the causes and nature of which were wholly unknown. In fact, John Jones attributed inflammation in all cases to pain and irritation and taught that measures of prevention or treatment had little influence "without premising opium."

The principal operations were amputations, cutting for stone, cutting fistulous tracts, and opening abscesses. John Jones cut for stone, but that was not a part of military surgery. The major part of surgical work was dressing suppurating wounds; the surgeon's best omen was pus. The care of backs suppurating as the result of flogging was an important part of the military surgeon's work. Even simple fractures and dislocations were crudely treated and bad results must have been frequent.

There were types of wounds not seen today, for example the case of Captain Greg, related by Thacher. Greg was shot through the arm and chest, tomahawked in the back and head, and scalped, yet he was nursed through to health. Scalping was performed by the Indian as follows: "With a knife they made a circular cut from the forehead quite round, just above the ears, then taking hold of the skin with their teeth, they tear off the whole hairy scalp in an instant, with wonderful dexterity."

In the Revolutionary War as in the World War military surgery was the surgery of America, its best and its less than best. Its growth since then has been the growth of American surgery, just as its growth in the future will be. Military surgery never has been in America a thing apart and different from surgery in general. I hope it never may be, that always, when an advance is made in surgery that advance will find early and general application in civil and military life.

Surgery in America, like medical education, made little advance from the time of our Revolution to the War of 1812. Military surgery in Europe, under the leadership and example of such men of genius as Percy and Larrey, had made great advance along the lines of prompt and efficient aid to the wounded. But the lessons taught were either unknown or made little impression in America. Military preparedness was nil and our conduct of the war in general was not brilliant, our hospitals no better. The principal record of military affairs in the War of 1812 is Surgeon James Mann's *Sketches*. Therein we find a very intelligent discussion of the surgical work of the day.

Mann had read Larrey and he discusses his indications for amputations on the battlefield, agreeing with him in most instances but not in all, contending that many joint injuries and fractures in the upper parts of limbs would do well under treatment. His opinion was based upon experience, his own and that of others. He was happy in escaping the most serious wound infections and he states that he saw no tetanus, hospital gangrene, or other "infection." This he attributed to his care in whitewashing walls, sanding floors, and maintaining strict cleanliness in his hospitals. He said: "When patients die in foul hospitals, the surgeons are as culpable for their deaths as if they had been improperly treated by medicine or wholly neglected." He was a believer in the antiphlogistic treatment of wounds by bleeding and purging and said that the more blood expended the better in wounds of the viscera, provided life is not extinguished when hæmorrhage is stopped. "A soldier at Greenbush was wounded with a bayonet, which entered the left of the spine and passed through the trunk below the diaphragm. This man was attacked with puking and suffered extreme pain. He was bled immediately; the operation was repeated as pain indicated until he lost 2 quarts in 36 hours. . . . Within 3 days the puking ceased and the man became composed. At the expiration of 3 weeks the wound healed without suppuration."

William Beaumont has left us a somewhat naive and emotional account of battle surgery after the battle of Yorktown, Canada.[1]

> A most distressing scene ensues at the Hospital—nothing but the Groans of the wounded and the agonies of the Dying are to be heard. The Surgeons wading in blood, cutting off arms, legs, and trepanning heads to rescue their fellow

[1] Myer, Jesse S. Life and Letters of William Beaumont. St. Louis: Mosby, 1912, p. 44.

creatures from untimely deaths. To hear the poor creatures crying "Oh, Dear! Oh, Dear! Oh my God, my God! Do, Doctor, Doctor! Do cut off my leg, my arm, my head, to relieve me of my misery! I can't live, I can't live!" would have rent the heart of steel and shocked the insensibility of the most hardened assassin and the cruelest savage. It awoke my liveliest sympathy, and I cut and slashed for 48 hours without food or sleep. My God! who can think of the shocking scene when his fellow creatures lie mashed and mangled in every part, with a leg, an arm, a head or a body ground to pieces, without having his very heart pained with the acutest sensibility and his blood chill in his veins. Then, who can behold it without agonizing sympathy!

Indicative that little surgery was done was James Tilton's *Summary Report on the Diseases of the Army from the Commencement of the War in 1812 to its Termination in 1815* in the third United States Military District, including New York City and surroundings. The total amount of diseases was as follows: intermittent fever 625, remittent fever 1,256, typhus fever 551, dysentery 1,269, diarrhœa 1,945, all other diseases 6,309.

There were few operations to exercise the skill of the surgeons employed in this department. Two amputations only were performed during the whole time and one operation for hydrocele. The saphena vein was tied up in four instances, according to the method of Mr. Freer, the result of which was rather unfavorable to his plan of operating in such cases.[1] This last operation was for varicose veins, which were common in soldiers. The saphena was ligated and removed shortly afterward.[2]

We find no American record of medical events in Jackson's army at New Orleans. "A Naval Surgeon"[3] gives a good account of them in the British forces. There were many wounded, much sickness from scurvy, diarrhœa, dysentery, liver abscess, intermittent, remittent, bilious and ardent fever, including yellow fever, but no surgery. Venesection, yes, enough to satisfy Benjamin Rush himself. For yellow fever he bled to syncope and repeated it again and again. Then gentle purgation from the use of 3 or 4 grains of calomel every 3 or 4 hours gave excellent results, but the main benefit was from the bleeding.

Gross tells us that the bracket splint for compound fractures was introduced during this war.

W. E. Horner in 1852 (then Professor of Anatomy at the University of Pennsylvania) wrote[4] entertainingly of his experiences as a surgeon's mate in the War of 1812. He relates little of importance that was not told by Mann. Ointments and cerates, particularly basilicon, were used in dressing nearly all wounds, and poultices he preferred to cold water dressings prior to the onset of suppuration.

The losses in the fighting in northern New York in 1814 were extraordinarily heavy and the burden upon the hospitals great.

> Under these circumstances many soldiers were treated in the outskirts of the hospital, by their wives or females having an attachment to them. With such assiduities, recoveries took place which would scarcely have followed in ordinary hospital practice.
>
> Bullet wounds which did no injury to bone or to the great cavities generally did well.
>
> Out of many cases of fractured os humeri or os femoris which I saw, a majority of the patients died or were compelled to submit finally to amputation.
>
> During the heat of the summer our large amputations were very unsuccessful so much so as almost to discourage us from performing them: many of the recent stumps mortified; in others that did not, the patient gradually sank into the arms of death.
>
> Wounds attended with much discharge were frequently infested with maggots, the ova of which were deposited by flies-(musca carnaria) in the bedclothes and dressings. This accident will probably be attributed to negligence, but the most diligent of nurses could not prevent it.
>
> At one time the author had the sole attendance and dressing on one hundred and seventy-three sick and wounded. My fingers became so sore from incessant dabbling in water and in pus, that I could seize nothing without pain, and was constantly liable to let articles fall, from the sudden twinges of agony in touching them.

Horner discussed at length the moot question of early or late amputation for gunshot fracture and said:

> Our own general conclusion from what we have seen and learned would be, that amputations in the length of the bones of the upper extremity, anywhere below the shoulder joint, may be performed indiscriminately, either at once or subsequently. Perforations by balls through the elbow or wrist, in their ulterior consequences, involve great hazard to the life of the patient, but some patients recover. It is perhaps, therefore, better to delay the amputation, as there is no immediate danger for the most part. Compound fracture of the thigh is imminently dangerous, either with or without regular amputation. An intermediate plan has therefore been suggested, which, for similar reasons, may be applicable to the leg also, to-wit: the excision of the limb through the ray of attachment, and the simple squaring off of the ragged end of the bone.

There were some well marked advances in surgery before the Mexican War, notably McDowell's ovariotomies and operations for the cure of hernia. Plastic and ophthalmic surgery had also progressed[5] but none of these advances had yet found a place in military surgery, so far as I know. The great and outstanding advance of the time was the introduction of anæsthesia,

[1] Med. Repos., iii, 407.

[2] Med. Repos., ii, 306.

[3] Edinburgh M. & S. J., 1916, April 1, 126–159.

[4] Medical Examiner & Record of Medical Science, New Series, viii & ix.

[5] S. D. Gross. A Century of Medicine, 1876.

which found prompt application in the army. The official records of the surgery of this war are as defective as for the War of 1812 or the Revolution, but two surgeons published informing articles with good description of their work. The fuller of these writings were those of Surgeon John B. Porter, U.S.A. Porter[1] describes about 30 gunshot wounds, discusses the principles of treatment laid down by Larrey and by Guthrie, and expresses his own opinion.

He agrees that (1) "wounds of the head, unless slight, may be considered dangerous." He details five cases, ranging from slight to severe, in all of which the treatment was purely expectant.

2. "Desperate wounds of the face, lower jaw, throat and neck often recover." He describes three illustrative cases.

3. He agrees with Guthrie that amputations should not be done for gunshot fractures of the upper extremity, therein departing from Larrey's teaching. He reports four cases all recovering and saving their limbs. Even a paralyzed arm is better than none.

4. "Penetrating wounds of the chest are dangerous," but he reports two cases resulting in recovery. One of these was apparently not penetrating and in the other the missile was a buckshot.

5. "Gunshot wounds of the abdomen are always fatal." This he emphasizes by two case reports, but he also admits that recovery has occurred in rare cases.

6. Wounds of the pelvis and parts adjacent are exceedingly dangerous. He reports two corroborative cases, one suggesting carelessness in examination. "The shot struck the upper part of the thigh and inguinal region, external to the large artery. There was no mark of exit. He was brought into hospital late at night, and on examination the wound appeared exactly like having been made by the brush of a ball passing by and just touching the integuments and cellular membrane; and what added to this impression was that there were no constitutional symptoms, and the patient actually walked, voluntarily, several steps to the bed provided for him." Two weeks later he died. "Autopsy. The head of the femur was shattered into several pieces, and the acetabulum was shattered in all directions and driven in: the grapeshot was found imbedded in the glutei muscles."

7. "Gunshot wounds of the lower extremity are much more serious than those of the superior. Wounds of the foot and leg do not by any means recover so readily or so perfectly as wounds of the hand and forearm, and gunshot wounds of the upper third of the femur are among the most terrible that can be inflicted." He details thirteen cases in support of this thesis, one particularly interesting because used to point a moral in regard to the use of ether anæsthesia. "But the operation was not successful, nor was this surprising." On making the incision the blood was dark and venous, as it was from the arteries also. The muscles were darker than usual. Adhesion did not occur between the flaps and after granulations sprang up it was found that the flaps were too short to cover the bone. The explanation follows: "In this case the blood was poisoned, and the muscular contractility destroyed: hence the soft parts were found insufficient to cover the bone after the patient had recovered from the deleterious effects of ether. . . . I have often thought that the effect of the inhalation of ether in those cases in which it was employed was as injurious as any other malign influence whatever . . . at the close of the war I had determined never to use it again." Let us hope that he changed his mind.

Flesh wounds Porter dressed with lint, adhesive plaster, and a few turns of a roller bandage, wetting all with cold water or lead lotion. If laudable pus did not appear at the proper time he also used poultices. It was never expected that a gunshot wound, however simple, would heal by first intention.

Suppuration and sloughing always occurred.

Gunshot fractures not requiring amputation were treated like flesh wounds after loose fragments and foreign bodies were removed.

Porter discussed but did not use débridement. He made the proud boast that "not a single case of hospital gangrene, tetanus or secondary hæmorrhage was seen by the writer during the war with Mexico." It is improbable that any man with as much experience in the Civil War could say so much. Porter discussed the antiphlogistic treatment (bleeding and calomel) for wounds and expressed the opinion that most American soldiers do not require it, but he recites a case in which he believed it saved life. "The bayonet entered between the seventh and the eighth ribs, wounding the lung, from which there was tremendous hæmorrhage. Surgeon Haskell . . . saw the man and bled him copiously. He was again bled as soon as reaction and hæmorrhage came on. These decisive bleedings doubtless saved the man's life."

W. B. Herrick,[2] Professor of Surgery at Rush, wrote of his experience. It was the practice to remove with care any foreign material in the

[1] Am. J. M. Sc., for the years 1852, 1853, and 1858.

[2] Illinois & Indiana M. & S. J., 1847–48, iv, 225–414.

wounds and then to dress them with lint and bandages. For hæmorrhage he used compresses and tight bandaging. Ligation was rarely resorted to. If amputation was deemed necessary it was done at once. Herrick favored heavy, moulded pasteboard splints for comminuted gunshot fractures.

Between the Mexican and the Civil wars surgery made notable advances. Three surgical specialties, gynecology, rhinolaryngology, and operative ophthalmology, all became useful realities. More important from a military standpoint was the enlargement of general surgery, the increase in operative work, consequent upon the introduction of anæsthesia.

Of tremendous importance also was the fact that the Crimean War had been fought, with losses due to preventable diseases which shocked the world, had brought Florence Nightingale to her great work of mercy and reform, had led to the making over of the Royal Army Medical Corps, but was unable to dent the self-complacent stupidity of the French *Intendance*. Thus it happened that the world was treated to a great object lesson, losses alike terribly great in the English and the French armies one year, in the next thirteen times as high in the French as in the English army.[1] With this lesson in view efficiency in our Medical Department was a necessity, but not a fact. Hence the importance of an outside agency, the Sanitary Commission, to bring about a reform. That is a great story which I should like to tell, but I have not the time. However, the reform resulted in good evacuation of the wounded, good hospitalization, and, with its agony almost removed by anæsthetics, operative surgery practiced on a scale never before seen. There were hundreds of skillful operators, more hundreds less skillful. Amputations, exsections, ligations, were on a scale unprecedented. There were even some attempts at surgery of the abdomen, chest, and cranium. Unfortunately, no more was known of asepsis or antisepsis than in our preceding wars. Lister himself had not taken the matter up, so infections were general. Pus, erysipelas, abscesses, septicæmia, pyæmia, hospital gangrene kept mortality high and surgery low. Happily these evil complications were not aided by such bleeding, salivation, purging, and blistering, as had been used in our earlier wars. Still, surgical mortality was high.

You all know something of the *Medical and Surgical History of the War of the Rebellion*, although not so familiar with it as surgeons of one or two earlier generations. The three enormous surgical volumes discuss in great and informing detail the classes into which the 245,790 wounds were divided, their treatment and results. Here we learn that there were 900 operations on the skull, 138 operations for gunshot wounds of the neck, including 29 ligations and 14 laryngotomies or laryngotracheotomies, five of them successful. Plastic surgery was practiced occasionally for face mutilations. There were 62 operations for wounds of the vertebræ, including removal of bone fragments and of bullets. Ten surviving cases are reported. For perforating wounds of the chest "hermetical sealing" came into use with splendid results when infection was escaped. This was, of course, a step in the direction of Lister's later work. It was done early, by means of lint and collodion. There were 494 operations for chest injuries, with 198 deaths. There were 8,715 penetrating gunshot wounds of the chest, with 5,260 deaths, so the operative cases gave much the better results. Enterorrhaphy was practiced, 62 cases of wounds of the liver recovered, and 444 of 3,717 abdominal wounds. The compilers of the history advised laparotomy for abdominal wounds thereafter. They also stated that bleeding was not used for such wounds in the Civil War. Many medical men still used mercury for its antiphlogistic effects, but opium was the mainstay.

Amputations were still extensively practiced for gunshot fractures, and excision of bones or parts of bones were also often resorted to in lieu of amputation, but as experience accumulated it became evident that conservative treatment yielded on the whole better results, more survivals, than either amputations or excisions. The mortality for all excisions was 27.6 per cent for all (29,980) amputations, from finger to hip joint, 26.3 per cent. All arteries up to and including the common iliac and the innominate were ligated. Surgery was manifestly bolder, more skilled, and more successful than in earlier wars. The tales of hospital gangrene, erysipelas, and other serious infections lead us to think they were common. In fact, they were not. There were but 1,097 cases of traumatic erysipelas, or 0.4 per cent of wounds, but 2,642 cases of gangrene, including hospital gangrene, but 505 of tetanus. Pus, if "laudable," was not regarded as pathological and mere suppuration was not included among "infections."

The Civil War taught surgery to thousands, it made operations familiar, it prepared the way for the great expansion which followed the practice

[1] Sieur Histoire des Tribulations du Corps du Santé militaire. Bull. de la Société Française d'Histoire, 1928, xxii, 92–168.

of antisepsis, with its virtual removal of danger. But in the decades immediately following the war the dangers were still great and surgery was mainly work of necessity, although, as Gross said, every doctor was doing it.

Before 1880 a small number of American surgeons had taken up Lister's practice. Among the early advocates of it was Captain A. C. Girard, who in 1877 wrote enthusiastically in regard to it. His article was published in the *Medical Record*[1] and to the service in a circular of the Surgeon General's Office. In 1878 a spray apparatus was issued to the service. In 1892 the antiseptic first aid packet, of German origin, was adopted in our service and antiseptic surgery was being relatively widely used.

The Spanish American War was, on land, mainly a war of small arms, of small pointed bullets. The wounds were for the most part mild, the first aid dressings were effective, and most wounds healed without infection. Surgically the war was a success. That and the subsequent Philippine campaigns again popularized surgery. So safe had it become, so self-reliant its disciples, that we actually have the official record of a thoroughly successful amputation above the elbow performed by two hospital corps men in the Philippines, neither of them a medical man. (S.G.R., 1900, p.160.)

Anæsthesia and antisepsis enabled many men to do operations for the selection and application of which neither their education nor their judgment qualified them. As a result surgery suffered some discredit for a while.

In the World War the surgery was done by you gentlemen from civil life. So tremendous was the expansion of the Medical Department that it was necessary to place practically its entire regular personnel into administrative work, and few were the regular officers who could do professional work.

[1] Med. Rec., 1877, xii, 721–726.

Concerning the surgery of the World War I shall not attempt to tell you, because you know it as well as I, or better. I may properly express my gratitude that we had you to do it, that it was the greatest surgery of any war in history, that its results were better than ever before, that the Government's care for the soldier extends to the present time in all cases needing such care.

Despite the fact that two-thirds of the wounds were made by explosive missiles, 90 per cent were saved. A few comparisons with Civil War results are interesting.

PERCENTAGE OF DEATHS

	Civil War	World War
Wounds of cranium	60	40.8
Wounds of chest	62	39
Wounds of abdomen	87.5	43.4
Wounds of ankle joint	53	16.67
Wounds of knee	54	12.5
Wounds of hip	85	22.2

The advances in the treatment of deformities, in orthopedic, plastic, and head surgery can scarcely be estimated, except to say that they were very great.

What regular officers, Colonel Keller for example, have done for the chronic bone cases, chronic empyemas, and such other sad sequelæ as have been under treatment since you left the service, I believe you know. I believe that, with me, you are proud of it, that you feel that it has been most creditable to the profession.

With the most cordial hope that the mutual pride of the surgical profession and of the Medical Department in one another shall never change except in the way of increase, that in time of need we may ever be mutually helpful, I convey to you the gratitude of my department for what you are to us.

PRESENTATION OF CANDIDATES FOR FELLOWSHIP[1]

FRANKLIN H. MARTIN, M.D., CHICAGO
Director General, American College of Surgeons

Mr. President: Each year as we receive a new class of candidates into Fellowship I am impressed by the prestige of an institution that can influence such a goodly number of busy practitioners of surgery to seek its portals.

To the casual observer these men appear as one more group that is being enrolled into our ranks. Complacently, this observer shrugs his shoulders and reflects: "How easy!"

May I remind this observer, and this audience that has honored us with its presence, that the majority of this goodly number of successful candidates who have presented themselves have been reminded by their successful entrance into the American College of Surgeons of a well worn saying. It compares the chances of entry into Heaven of a successful Captain of Industry with the chances of a certain deformed animal to pass through the eye of a needle.

As an illustration:

There were 4,197 applications for Fellowship on file January 1, 1929; 664 of them had already received the approval of State or Provincial Committees on Credentials; 1,424 were presented to State and Provincial Committees on Credentials during this year, 1929, of which only 678 or 47.5 per cent were approved and recommended for examination. Of the total recommended for Fellowship before and since January 1, 1929 (1,342), our careful sifting process has admitted to Fellowship only 669 or 49 per cent constituting the candidates who are here present.

Surely if we pay tribute where tribute is due we must pay full portion to the magnificent group which is before us this evening. Veritably they are the survival of the fittest.

They are to be congratulated; and the *College* is to be congratulated; but above all, we must congratulate the people who shall in the future seek their services.

CLASS OF 1929

United States	642
Canada	11
Hawaii	7
Porto Rico	1
Australia	1
France	1
India	1
Japan	1
Persia	1
Siam	1
South America	2
Total	669

[1] Convocation, American College of Surgeons, October 18, 1929.

THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY[1]

MERRITTE W. IRELAND, Major General M.C., U. S. A., D.S.M., F.A.C.S., Washington
Surgeon General, United States Army

FEELING that you bestowed upon me the high honor of your Presidency for the reason that I am the head and so the representative of another organization with which most of you have had close affiliation, the Medical Department of the Army, I cannot do better than to talk of this and of its contribution to civilization.

The need for a military medical organization became apparent at Bunker Hill. Massachusetts provided it temporarily, but one of Washington's early recommendations to Congress was for the establishment of "an hospital," meaning thereby a medical service outside of the regiments. This Congress did, and during the period of the Revolution it frequently legislated in regard to the hospital. Some of the legislation was very liberal and gave to the medical authorities great apparent freedom to do whatever was necessary. The country was poor, inexperienced, poorly organized and the doctors had no military rank. It would be easy to argue that these circumstances prevented the success which they would otherwise have had, but I do not believe that it would be honest. They were very much more hampered by the ignorance of their day than by laws. To outline briefly the military medicine of the day let us consider some of its branches.

Anatomy. Gross, descriptive anatomy was pretty well known to a few. Most medical men of America had not dissected a body.

Physiology. This subject was still pretty primitive. The functions of the nervous system were known very slightly. Harvey had, of course, demonstrated that the blood circulates and Malpighi had shown the capillaries, but most teachers, even so great ones as Blumenbach, Haller, and Cullen, did not speak of them, but said that the arteries emptied into veins and the veins rose from arteries. Digestion was quite a mystery. The best work done upon it up to the time of Beaumont, 50 years later, was that of Spallanzani, whose ingenious experiments taught much about gastric juice, but not that it was acid.

Respiration could not be understood, as oxygen and carbon dioxide were just becoming known and Lavoisier himself had not yet wholly clarified his own views. Obviously, then, all cellular metabolism was unknown.

Electro-Physiology was not yet in terms of speech or thought. There was much speculation as to humors of the body, but they were hypothetical humors, totally unrelated to the antibodies and hormones which might be so classed today.

Pathology had not passed, in America it had scarcely grasped, the organ pathology of John Hunter. The cell, its physiology, and disturbances were unkown. Medicine was scholastic, practice governed by "systems" founded upon hypotheses, some of them fantastic. The cause of no disease was known and the room for speculation was infinite. The means of investigation of disease were the unaided senses, and these gave information mainly as to symptoms. The most esteemed art used in diagnosis was the palpation of the pulse. There were no instrumental aids to diagnosis, no clinical thermometer, no blood pressure apparatus, no stethoscope or other "scope," no chemical or microscopic examination of blood or excreta. The distinction between diseases and symptoms was by no means clear, and fever, jaundice, dropsy, cough, diarrhœa, and vomiting were treated as diseases in themselves. Many men, notably Cullen, tried to differentiate diseases into many kinds and to classify them into genera and species. Benjamin Rush in his *American System* taught that these efforts were unnecessary, vain, and even harmful, and that what was necessary was to know the "nature" of the diseases, whether they required depletion or stimulation. Such were the stimulating qualities of the American climate that nearly all diseases in this country required depletion. This meant bleeding, purging, vomiting, low diet, sweating, and salivation. Alcohol, food, "bark," opium, and blisters were stimulating. Salivation, in addition to its depleting virtue, was regarded as specific treatment for all fevers. James Tilton expressed the general belief and practice when he wrote: "This Sampsonian remedy has the power of subduing all manner of contagion or infection that we are as yet acquainted with." Tilton was head of the Medical Department in the War of 1812.

Materia Medica included no alkaloids or isolated active principles, merely crude drugs, most of them nauseous and many valueless.

None of the present day specialties was practiced as such. One man could acquire all medical knowledge, and one year of medical school was all

[1] Presidential Address delivered at the Convocation of the American College of Surgeons, Chicago, October 18, 1929.

that was ordinarily required for the diploma. We learn from Thacher's *Medical Biography* that Josiah Bartlett was surgeon's mate in the Revolution at the age of 16, and John Thomas of Massachusetts was surgeon's mate at 17 and regimental surgeon at 18 years. Both of these men later attained prominence in their profession.

Surgery, without asepsis, antisepsis, or anæsthesia, was necessarily crude and unsatisfactory. Amputations were frequent and pus was the surgeon's best omen.

Hygiene had scarcely advanced beyond the teachings of Moses in any directions. In some respects it had fallen lamentably behind.

In such circumstances as the preceding remarks indicate the medical service (not yet a corps) of the United States Army came into being. The average number of medical officers in service from the Revolution to 1830 probably did not exceed 30 to 40. They were usually isolated in small places, yet from one of these, a lone doctor in a frontier post separated by a hundred miles of distance and a week of travel from his nearest fellow-physician, came America's first large contribution to scientific medicine.

William Beaumont, post surgeon at the fur trading, frontier post of Fort Mackinac, was the contributor and his contribution was the brightest light thrown upon the physiology of digestion up to that time. An accident of rare and happy outcome gave him the opportunity to observe in the living body the appearance, action, and digestion by the healthy human stomach. Although without a medical degree, Beaumont was blest with an inquisitive spirit, a clear mind, the powers of concentration and perseverance. Alexis St. Martin's accident afforded him the means for making observations of great importance, and his clear understanding and lucid style enabled him to relate most interestingly what he had observed. Before him the subject of digestion was almost pure speculation. Even Spallanzani, whose observations and experiments were the most important prior to Beaumont's, failed to recognize that the gastric juice was normally acid. Prout isolated free hydrochloric acid from it in 1824, but no one knew the story as Beaumont told it.

Beaumont drew 51 inferences from his observations, all of them new to most medical men, and it may be said that more than 90 per cent of them are valid today and are among the fundamentals of the physiology of digestion. His most striking mistake was the belief that "every species of aliment produces the same kind of nutrient principles," which he called, for convenience of illustration, a *gastrite* of *aliment*, as one might speak of a *nitrite* of *sodium*.

Next in scientific importance, and of about the same time, was the Medical Department's system of weather reports, instituted by Surgeon General Lovell and sent in from all posts. These were the beginning of the weather bureau service. In 1844 the first weather maps were made in the Surgeon General's Office. It was not until 1870 that the weather reporting was transferred to the Signal Corps, which in turn transferred it to the Weather Bureau in 1890.

During the Mexican war our contribution was valor and hard work, little else. In the 1850's the Pacific railway surveys were made and many medical officers contributed interesting and useful observations on the fauna, flora, ethnology, and archeology of the regions traversed. Most interesting were Dr. George Suckley's reports as surgeon of the party exploring the Northern route.

Another type of contribution to civilization, that of the hardy, fearless Indian fighter, is revealed in Surgeon J. B. D. Irwin's of Apache warfare experiences in 1858. Irwin and his like were contributors of the type of Daniel Boone and Kit Carson. Bravery, resourcefulness, initiative, and responsibility were their characteristics.

The greatest contribution from the Medical Department in the Civil War lay in the organization, systematization, and co-ordination of medical work, especially in the removal, transportation, and subsequent care given the wounded. This excelled anything of the sort previously done. It served as the model from which were built the systems of evacuation and hospitalization used in the World War. For this great contribution we are indebted principally to two men, Surgeon General William H. Hammond and Surgeon Jonathan Letterman, the two great medical officers of that great time. The story of their work is romantic, that of Hammond melodramatic. To his initiative and his orders we are indebted for the material for the Army Medical Museum and the *Medical and Surgical History of the War of the Rebellion*. I suspect that his "Calomel Order," Circular No. 6, 1863, was truly a great step in freeing us from blind subjection to the systems of the past, particularly the teachings of Benjamin Rush. Recall that James Tilton said that "besides syphilis, itch, etc., without fever, it is regarded as specific in smallpox, measles, scarlatina, influenza, yellow fever, etc., and is found to be not less successful in the early stages of jail fever. Hence it is that in yellow fever, remitting or any other fever, if we can only touch the patient's mouth with mercury, we regard him as safe."

The same belief obtained to the time of the Civil War, and inspectors reported "innumerable" instances of salivation and very many of mercurial gangrene. Hammond thereupon ordered the drug stricken from the supply table. The row caused was immense, but the order stood and it must have had the effect of causing men to search their memories and their experiences. It was about as definite a break from an evil past as was possible.

The professional work of the Medical Department in the Civil War is preserved in the great Medical and Surgical History, still a mine of most valuable information for the man who is not too busy to read the medicine and surgery of 60 odd years ago. The impression it made upon the scientific world of the time was expressed by Virchow. "Whoever takes up and reads the extensive publications of the American Medical staff will be constantly astonished at the wealth of experience found therein. The greatest exactness of detail, careful statistics even about the smallest matters, and a scholarly statement embracing all sides of the medical experience, are here united in order to transmit to contemporaries and posterity in the greatest possible completeness the knowledge purchased at so vast an expense."

The principal compilers of this great work were Surgeons J. J. Woodward, G. A. Otis, and D. L. Huntington. Woodward was also an American pioneer in photo-micrography.

While the *Medical and Surgical History* was being published the *Index Catalogue* of the Surgeon General's library was also going forward under John S. Billings. I have no doubt that it is now the greatest medical bibliography ever prepared. It is used throughout the world.

But Billings' work was by no means limited to that. He was a prolific writer and a man of great breadth of vision. In 1870 he was detailed to make a survey of and recommendations for the improvement of Marine Hospital Service, then the football of local politics in the various ports of the country. He took two years for the work and made recommendations which led to immediate improvement and started the growth which has resulted in the splendid Public Health Service of which we are all proud today.

Billings also planned the Johns Hopkins Hospital Medical School and brought together the group of great men whose individual and team work placed it just where he had planned, in the forefront of medical teaching in the world. After his retirement he continued library work, planned the building, the methods, the administration, practically made the New York City Public Library. Few Americans, if any, have made four such worthy contributions to civilization as did Billings. You, who are writers and investigators and who know, will agree with me that American medicine is the richer and much better informed because Billings' mantle has fallen upon the shoulders of the erudite, indefatigable, and modest medical officer whose *Introduction to the History of Medicine* is a work of which American scholarship is proud. Colonel Fielding H. Garrison is still among us taking notes and making scholarship attractive.

In 1886, F. C. Ainsworth, an assistant surgeon, was put in charge of the Record and Pension Division of the Surgeon General's Office, then almost ten thousand cases in arrears and requiring an average of two and a half to three months to look up each case. In the following year the work was brought up to date. Ainsworth introduced the card index system into business, and I suspect that business men will agree that that was a contribution to civilization.

In this period of small things, many medical officers took up hobbies, with which they did interesting work. Some studied the classics, some music, some languages. Most largely useful were the branches of natural history, such as ornithology, ichthyology, mammalogy, and Elliott Coues, Edgar Mearns, Robert Shufelt, and others made notable and important contributions to the knowledge of American fauna and flora.

Real and effective control of most infectious diseases other than smallpox we now know could be expected only after the rise of bacteriology and modern hygiene.

It is interesting that Assistant Surgeon A. C. Girard was one of the early American supporters of Listerism of antisepsis and that, as a result of an article of his, published in 1877, an antiseptic equipment with spray apparatus was issued by the Medical Department in 1878.

It was also in the 70's that George M. Sternberg began his work in bacteriology. He was the father of that science in America, and as such, one of the foremost men in public health work. Yellow fever was then a yearly menace to our commerce and our coasts and Sternberg did much work in efforts to elucidate it, and almost as much in proving the mistakes of others and less conservative men who from time to time announced that they had discovered the cause.

When the Spanish-American War left us with tropical possessions on both sides of the world General Sternberg promptly undertook the acquisition and dissemination through his Corps of knowledge in regard to tropical diseases. He

appointed boards for their study in Cuba, the Philippines, and Porto Rico.

Because of Sanarelli's announcement at that time of his *Bacillus icteroides* as the cause of yellow fever, the board in Cuba, consisting of Walter Reed, James Carroll, Jesse Lazear, and Aristides Agramonte, was directed to concentrate upon the subject of yellow fever. The result you all know. By a series of brilliant experiments the board showed clearly, definitely, and for all time that the disease was conveyed by the mosquito *Stegomyia fasciata* (now known as *Aedes aegypti*) and not by fomites or contact; that the mosquito can obtain the causative germ from a sick person only in the first two or three days of his disease; that an interval of about 12 days or more after its contamination is necessary before the mosquito is capable of conveying the infection; that the incubation period in the patient varied from 41 hours to five days and 17 hours; that a house is infected with yellow fever only when there are present in it contaminated mosquitoes capable of conveying the parasite; that the spread of yellow fever can be most effectually controlled by protection against mosquitoes; that the specific cause of the disease is filterable and undiscovered.

This was a truly magnificent contribution to civilization, for yellow fever had been definitely retarding it in all Central and South America and to a less degree on our own and the Mexican Gulf coasts. It was costing thousands of lives, was keeping commerce depressed, was preventing the influx of capital and enterprise, had prevented the construction of a Panama Canal by the French, it had kept and was keeping Latin America poor, ignorant, and backward.

All that was needed to start those countries on the removal of their disabilities was a large scale demonstration of the practicability of applying the board's findings. That also was furnished by a medical officer, my illustrious predecessor, William C. Gorgas. First in Havana and later in Panama, he applied the findings, got rid of yellow fever, greatly reduced malaria, and made places of happy residence of what had been pest holes and world menaces. The Panama Canal was built, commerce, wealth, and general welfare increased, and civilization took on new and healthy growth. This story of scientific investigation, prompt application of the knowledge gained, quick and beneficent results is scarcely paralleled in history, scarcely excelled in romance. All America and all medicine are proud of it.

Meanwhile, the other Tropical Disease Boards were not idle. That in Porto Rico, particularly Bailey K. Ashford, began the investigation of the tropical anæmia which was so widespread and debilitating in that island, speedily determined that it was due to hookworm infestation, and undertook treatment upon a large scale, with good results. Similar and more complete campaigns are now going on in many parts of the world. This was a large gift to civilization, the full benefit of which came slowly, not with the dramatic promptness of yellow fever control. However, the complete elimination of hookworm disease would help more people than yellow fever control. This is also true of malaria, in the control of which our army has stood high.

The Tropical Disease Board in the Philippines early undertook work on plague, cholera, amœbic dysentery, animal parasites, and issued bulletins upon all these subjects which were of great value.

Meanwhile also the medical officer in the "bosque" with troops, living in a nipa shack, or an abandoned convent, was vaccinating natives by the thousands, was acting as sanitarian for native villages, towns, and provinces, was controlling epidemics of smallpox, cholera, bubonic plague, malaria, typhoid, tropical anæmia, was carrying the gifts of sanitation and health to thousands. This was surely a contribution to civilization.

You all recall our very unhappy experiences with typhoid fever in the Spanish-American War, due largely to our ignorance of its epidemiology, to a belief that it was only a waterborne disease. An army board (headed by Walter Reed but including Victor C. Vaughan and Edward O. Shakespeare, surgeons of Volunteers) investigated the camp epidemics and in a monumental report threw much light upon the manner of spread, although not recognizing the importance of human carriers in the kitchen and not enabling the British in the Boer War to escape experiences as unhappy as our own. Their experiences led the British to investigations looking toward immunization by means of bacterial vaccines. The work was not highly successful, but was sufficiently so to encourage further work in England, Germany, France, and India. In 1908, Major F. F. Russell, of our Medical Corps, was sent abroad to investigate the results of such research. After his return a board consisting of Surgeon General O'Reilly, six reserve officers (the first ever called to active duty), and Major Russell considered his report and recommended the use of bacterial prophylactic in our army. At the same time bacteriological examination of blood, stools, and urine of all cases, examinations for the detection of carriers, chlorination of water, and other advanced sanitary measures were instituted. The result was the

practical elimination of typhoid from the army, where it had been a scourge throughout all of our history. So striking were the results that the procedures were taken up by other armies and in civil life, and typhoid, once so common, is now a rare disease in this country and many others. Here was a great gift to civilization, a great accomplishment of medicine. The same measures, other than bacterial prophylaxis, which so reduced typhoid, also reduced dysentery, likewise a long time scourge to our army, formerly such to our country and still such in our tropical possessions. It is now relatively rare. Among the measures of general sanitation important in reducing these diseases, not only in the army but also in our cities and the cities of the world, it is probable that no single one is more important than the chlorination of water. This is applied in the field by the use of hypochlorite of lime, but that substance was difficult of application and uncertain in results when applied to the water supplies of great cities. To an army medical officer, the modest Carl R. Darnall, my office assistant, the world is indebted for the process of purification of water by the use of liquid chlorine and for the apparatus by means of which the treatment is effected. When I say that we are indebted for these things to Colonel Darnall I am not expressing a mere opinion. The patent offices of this and other countries recognized his priority by granting him basic patents and the United States Courts have upheld the validity and rightfulness of those patents. Here is a contribution to civilization which reaches into and benefits every urban home in America and in many other parts of the world.

The specific treatment of amœbic dysentery with ipecac was brought into prominence in our country by a medical officer, Colonel A. A. Woodhull, and the use of emetine followed the work of another, Colonel E. B. Vedder. Another officer whose work on dysentery and malaria has made him an authority on both is Colonel C. F. Craig.

A disease which was of primary importance in the Far East, several times as disabling to the Japanese army in the Russo-Japanese war as all communicable diseases combined, and very common among Philippine Scouts and in public institutions, was beri-beri. It had been investigated by British, French, Dutch, and Japanese workers, but again it was the American Army Medical Department which gave a large scale demonstration in practical control. The Tropical Disease Board in Manila recommended changes in the Scout ration which practically eliminated the disease in a few months. The same changes applied in the prisons, leper asylums, and Constabulary had the same effects, with great saving of life and prevention of invalidism. To the Far East the control of beri-beri is as important as the control of typhoid in the western world.

Another disease which has afflicted its many thousands in our army and our country is dengue. Benjamin Rush certainly talked of it under the title of bilious remittent fever, and under that title it was long confused with malaria and yellow fever. Tropical Disease Boards in Manila shed such light upon it that it is now as well understood as yellow fever, to which it has many resemblances.

An interesting view of the results of preventive medical work of the army at the present time and almost a century ago is obtained by comparing certain figures relating to the year 1841 with those relating to 1927. In 1941 the mean strength of the army was 9,748, the admissions to sick report 38,559, or 3,960 per 1,000, and the deaths 387, or 39.8 per 1000.

In 1927 the mean strength was 132,901, the admissions to sick report 87,002, or 654.6 per 1,000, the deaths 531, or 4 per 1,000.

The admission rate had fallen to one-sixth, the death rate to one-tenth of the earlier figure.

In 1841 almost half of the army, a mean strength of 4,738, was in Florida. The admissions to sick report there amounted to 21,027, or 4,430 per 1,000, the deaths to 254, or 53.6 per 1,000.

In 1927 the troops in Panama numbered on the average 7,179. The admissions to sick report were 6,185, or 861.54 per 1,000; the deaths 29, or 4.04 per 1,000. The sick admission rate in Panama in 1927 was but one-fifth that in Florida a century earlier, the deaths less than one-thirteenth.

Even more striking are the death rates from certain groups of diseases, as follows:

Diseases	Death rate per 1000 in 1841	Death rate per 1000 in 1927
Fevers— Typhoid, Typhus, Malaria, Yellow	9.1	.05
Dysentery, Diarrhœa	14	.04
Pulmonary Tuberculosis, Phthisis, Hæmoptyses	3	0.2
Pneumonia	1.2	.31
Peritonitis, Appendicitis, Typhlitis	2	.15
Alcoholism, Intemperance, Delirium tremens	1.2	.05

It is obvious at a glance that our great savings of life have been in the groups of fevers, diarrhœa,

and dysentery, but it is greatly heartening also to observe the notable saving from those great respiratory killers, phthisis and pneumonia.

Pneumonia we are apt to think of as being as deadly as ever; appendicitis causes the laity to wonder why our ancestors did not have it; and prohibition has given deaths from alcoholism such news value that we see more reports of them in the newspapers than we saw years ago. The figures here quoted show that deaths from all of these are now rare as compared with 1841.

There is much of which I should like to tell you as showing the progress of medicine and of the Medical Department, but I may not take the time. But allow me to remind you that the official history of the *Medical Department in the World War*, a work comparable to the *Medical and Surgical History of the War of the Rebellion*, is now complete, the last volume in the hands of the printer, and that I hope and believe it will prove as great a mine of useful information as did the last named work.

I can not close this much condensed account of the work of the Army medical service without expressing my great satisfaction that the Department no longer, as through the greater part of its history, consists solely of medical officers. Not only has it its own enlisted personnel, but it includes the Dental, Veterinary, Medical Administrative and Nurse Corps, and by virtue of that fact its usefulness in the future promises to be greater than in the past.

Nor can I withhold my appreciation of the happy relations it now has with the great medical services of the Navy, the Public Health Service, and the splendid civil profession upon which it has called and will call, and never call in vain, for help in time of trouble. Most of you were with us in person in the late war, all of you in spirit. The honor you have done me is a gesture of good will which I and my Department appreciate most gratefully, a guarantee of co-operation and perhaps guidance in our next great task, the control of the respiratory diseases.

THE MEDICAL REVOLUTION[1]

A Study in the Humanization of Science

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I SHALL not speak to you in terms of your limited specialism as surgeons, but in terms of your larger significance as members of the high apostolate of healing. It would be a sterile presumption on my part, as a layman, to undertake to discuss any of the technical procedures of your craft, but, as the administrative head of a university of which a medical school and allied hospital units are integral parts, I sustain at least a Platonic relation to some of the larger issues of policy that confront your fellowship. And out of the experience of that relationship, I want, if I can, to capture a living sense of the particular phase of evolution through which, it seems to me, the practice of medicine in its varied modes and manners is now passing.

It was a crisp November afternoon. The tonic wine of autumn was in the air, making for clarity of mind and health of outlook. The presidents of half a hundred American universities had come together for mutual counsel. The fundamentalist-modernist controversy was at fever-heat. Here and there and yonder, legislators seemed bent upon taking learning in hand. There were disturbing signs of a renaissance of superstition. These presidents were concerned over the possibility of a popular movement that might compel the voice of science to echo the vote of the majority.

"Do you believe in hell?" asked one president of another.

"Why shouldn't I?" replied the other president, "I am just launching a medical school at my university."

The widespread reputation of medical schools as seed beds of dire difficulties for university administrators is not due, I am sure, to there being more prima donna temperaments among doctors than among engineers and lawyers, but grows naturally out of the fact that the world of medicine is today in the throes of a far reaching readjustment, in which even the wisest are sometimes at wit's end.

The historian of medicine will look back upon the period following 1875 as the time of the Medical Revolution, as the historian of industry looks back upon the period following 1779 as the time of the Industrial Revolution. In both instances new forces came into the field destined to alter profoundly the prevailing policies and procedures.

If I may generalize very broadly, this Medical Revolution was brought about by the entry of the science of medicine into a field before occupied in the main by the art of medicine. Medicine is admittedly both an art and a science. And the Medical Revolution will not bear its full fruit unless, as the ultimate result of its readjustments, the best in the art of medicine and the best in the science of medicine meet and merge, both in the practice of the physician and the program of the profession.

But revolutions are treacherous adventures unless they are engineered by men who possess both the hindsight of the historian and the foresight of the statesman. In revolutions we always run the risk of throwing to the winds the eternal as well as the obsolete elements of the old order. And I am not at all sure but that in the necessary promotion of the science of medicine we are today in danger of losing some of the precious values developed in the practice of the art of medicine over the generations.

The "old doc" of the sick-room as well as the "super-doc" of the laboratory must be reckoned with in any sound development of medicine. Old doc—I use the term in affectionate admiration—will always keep a tight hold on the heart-strings of humanity. I wonder whether you know Opie Read's whimsical picture of old doc as he knew him in the South of an earlier day. Let me share with you the pleasure I had in reading it.

> His house was old, with cedar trees about it, a big yard, and in the corner a small office. In this professional hut there was only one window, the glass of which was dim with dust blown from the road. In the gentle breeze the lilacs and the roses swapped their perfume, while the guinea hen arose from her cool nest, dug beneath the dahlias, to chase a katydid along the fence, and then with raucous cry to shatter the silence. The furnishings of the office were less than modest. In one corner a swayed bed threatened to fall, in another a washstand stood epileptic on three legs. Nailed against the wall was a protruding cabinet, giving off sick-room memories. . . . To go into his office and to come forth with no sign of heaving was a confession of the loss of smell. Sheep-shearing fills the nostrils with woolly dullness, but sheep-shearers could scent old doc as he drove along the road.

[1]Fellowship address delivered before the Convocation of the American College of Surgeons, Chicago, October 18, 1929.

In every country the family doctor is a natural sprout from the soil. His profession is almost as old as the day-break of time. He bled the ancient Egyptian, blistered the knight of the Middle Ages, and poisoned the arrow of the Iroquois. He has been preserved in fiction, pickled in the drama, spiced in romance, and peppered in satire; but nowhere was he so pronounced a character as in the old South. He knew politics, but was not a politician. He looked upon man as a machinist viewing an engine, but he was not an atheist. He cautioned health, and flattered sickness. He listened with more patience to an old woman harping on her trouble than to a man in his prime relating his experience. His books were few, and the only medical journal found in his office was a sample copy. When his gathered lore failed him, he was wise in silence.

At no place along the numerous roads traversed by old doc was there a signpost with a finger pointing toward the attainment of an ultimate ambition. No senate house, no woolsack of greatness, waited for him. The chill of foul weather was his most natural atmosphere; and should the dark night turn from rain to sleet, it was then that he heard a knock and a "Hello" at his door. Down through the miry bottom-land and up the flint hillside flashed the light of his gig-lamp, striking responsive shine from the eye of the fascinated wolf. The farther he had to travel, the less likely he was to collect his bill. Usury might sell the widow's cow, for no one expected business to have a daintiness of touch; but if old doc sued for his fee, he was met even by the court with a sour look.

Blessed be the memory of old doc! He may have been poor in scientific knowledge, but he was rich in human insight. He may have been awkward in handling test tubes, but he was adept in handling patients. He knew, without learning it from lecture room or laboratory, the subtle interdependence of mind and body. He was a psychoanalyst before the days of psychoanalysis. His sick rooms were secular confessionals in which he practiced a rare priesthood. His deficiencies were many, but, according to his lights, he was an apostle of the art of medicine. Modern medicine must perfect his technique and widen his knowledge, but it must not lose his spirit. Old doc, brought down to date, gives us a doctor who knows how to link the learning of the laboratory to the life of the patient, making that learning bring cure to men in the shadow of sickness and caution to men in radiant health.

For a long time old doc held the field. The art of medicine was dominant. And then the winds of a new critical and scientific spirit began to blow across the world. That spirit crossed all frontiers and on unseen wings flew through the closed doors of dogmatism and self-satisfaction everywhere until the whole of modern life was touched by it, medicine along with other fields. Today the science of the study of disease is slowly but surely transforming the world of medicine.

I shall not undertake to analyze or assess the innumerable studies, the varied sciences, the extensive researches, and the new techniques that are today playing a living part in the evolution of modern medicine. And for two good reasons: first, because I am a stranger to the detailed facts of modern scientific medicine; second, because it would be an old story to you, even if I were qualified to tell it. I purpose tonight a simpler undertaking, and one a layman may, perhaps, enter upon without too great presumption.

I want to deal with just one question: What are the implications of this Medical Revolution for the average man in the private practice of medicine and for the schools and hospitals in which we are training men for the private practice of medicine?

I think we may find a fruitful lead to an answer to this question by considering the new Medical Revolution in the light of the old Industrial Revolution. For, it seems to me, the private practitioner of the art of medicine, face to face with the organized promotion of the science of medicine, is in very much the position of the handicraftsman, when, at the dawn of the Industrial Revolution, science introduced machine power into industry. The parallel is, I think, both accurate and illuminating.

The handicraftsman, both in himself and in his system, had many virtues and many values that society could ill afford to lose as it moved over from a pre-machine to a machine economy. In like manner, the private practitioner of the art of medicine, both in himself and in his none too systematic system, has many virtues and many values that medicine can ill afford to lose as it moves over from a pre-scientific to a scientific basis.

Because there was not enough industrial statesmanship among the handicraftsmen, the evolution of industry got out of hand, many of the rarest values evolved by the handicraftsmen through the centuries were lost, and a vast high-powered industrial machine subjected the handicraftsmen to a ruinous competition they could not meet. In like manner, unless adequate medical statesmanship is brought to the direction of the present Medical Revolution by the men now in the profession, we may lose many of the rarest values evolved by the old practitioners of the art of medicine, and it may happen that a vast high powered medical machine, under the sponsorship of industries, insurance companies, and governments, will enter the field and subject the private practitioners of medicine to a ruinous competition they will be unable to meet.

Let me indicate the direction in which, it seems to me, things will inevitably move in

medicine in the absence of far sighted medical statesmanship on the part of the medical profession. One of the major marks of our time is an increasing interest in the prevention of disease. A growing determination to rid society of the waste and inefficiency due to disease is becoming one of the social passions of the period. This determination is heading up into certain very definite public and quasi-public movements that have intimate implications for the medical profession. Let me suggest the more obvious source of three such movements.

In 1909 it was estimated that at all times in the United States 3,000,000 persons were seriously ill. This meant an annual loss of 13 days per person on account of illness. It was then estimated that 42 per cent of this illness was preventable. About 3 years ago—when I last looked carefully into this situation—we had cut this loss from 13 to something between 8 and 9 working days per person. At that time about 42,000,000 persons were classed as gainfully employed in the United States. When these lose something over 8 days each year from illness, disabilities, and non-industrial as well as industrial accidents, it means that these 42,000,000 gainfully employed persons face an annual loss of nearly 350,000,000 working days. Disease must bear the blame for a staggering loss of working time. Of the 500,000 workers who die each year, it is considered probable, by dependable authority, that one-half of the deaths would prove postponable by adequate medical supervision, by medical examination, by health education, and by community hygiene.

Going on the conservative assumption that the average life—aside from its human values—is worth to industry, say, $5,000, and estimating the cost of special diet, nursing, and medical attention needed by a sick man at the very conservative figure of $3.00 a day, the economic loss from preventable disease and postponable death, in the situation I have described, reaches the staggering total of $1,800,000,000 annually borne by those gainfully employed in the United States. On the basis of the most dependable research available, it is estimated that this loss could be cut to a point where, over and above the costs of prevention, a balance of something near $1,000,000,000 annually could be left in the pockets of the working population and industries of the United States.

It is obviously inevitable that the growing enlightenment of labor leadership and the intelligent self-interest of industry should set about seeing to it that this unnecessary loss is stopped. Much has already been done by industry, but as yet only the surface of possibility has been scratched. And you may be sure that when the forces of labor and the forces of industry get fully under way, in a determined effort to lift from labor and industry this burden of loss from preventable disease and postponable death, they will not be concerned primarily with the effect of their program on the private practice of medicine.

There is, again, the rapid development of adventures in disease prevention and life prolongation by the big insurance companies. Here, as in industry, a powerful private economic interest is a driving force back of a socio-medical program. And here, as in industry, you may be sure that the insurance companies will not be primarily concerned with the effect of their program on the private practice of medicine.

In addition to these powerful private economic interests, making for a vast disease-prevention program, there is a growing social conscience respecting the issues of health and disease, a growing social conviction that the health of the social order is importantly interlocked with the health of its citizens.

We seem to be drafting a new definition of treason. The American public is about ready to agree with Lord Palmerston that "for every death from typhoid somebody should be hanged." We may, in time, make the first test of every industry its reaction upon the health of its workmen. No industry is profitable to the nation if it stunts the bodies and shortens the lives of its workmen, and some day we shall look upon the head of such an industry as a traitor to the state, although he may be a highly respectable citizen whose favorite indoor sport is tracking down radicals who have spoken disrespectfully of the Constitution. Some day we shall test every educational system by its reaction upon the health of its students. We shall insist that its buildings, its curricula, its teaching methods, its social organization shall conspire to conserve the student's health while he is in school and teach him to preserve his health after he leaves school. Some day we shall realize that an architect whose buildings are not conducive to health is a bad architect despite the beauty of line and mass he may have captured in his structures. And it may not be fantastic to think that some day we shall insist that grocers and cooks be licensed to pursue their crafts under the requirement that they know something about the relation of the selection and preparation of foods to the health of the American family.

The heads of industries that blight the health of their workmen, educators who forget the body in the training of the mind, grocers and cooks who are salesmen and servants only, architects who have not learned that a building must be useful before it can be beautiful in a social sense—all these will some day be regarded as biological traitors. Here, again, we have the beginnings, in fact, more than the beginnings, of a vast popular movement respecting health and disease, which, when fully under way, will not worry excessively about its effect on the private practice of medicine.

In short, there are today lying about us many if not most of the raw materials for a vast system of state medicine or its equivalent in the corporate medical activities of industries, insurance companies, and the like. As a general principle, I dislike to see any activity fall into the hands of government—whether it be an activity of business or labor or agriculture or the professions—if such activity can be administered equally well or better by the trade or profession to which the activity logically belongs. Society forever faces the dilemma of choice between an internal and an external control of its fundamental services. I prefer an internal control, not because I am a reactionary who grows hydrophobic at the suggestion of government control. I have rarely been accused of that. I prefer an internal control for the obvious reason that, as modern society becomes increasingly complex and technical, the man on the job should be better equipped for the job than the man on the sidelines. It is, I think, an intelligently progressive policy to consider government control of fundamental services only when internal control breaks down or plays truant to its responsibility. In the light of this principle, I raise the question: Is private medicine to be superseded by state medicine or its equivalent?

The answer to this question will, I think, depend entirely upon the quality of medical statesmanship displayed by the medical profession during the years immediately ahead. It would be presumptuous for me to undertake to discuss anything save the broader aspects of the medical statesmanship to which, it seems to me, the present phase of social insight and medical evolution challenges the private practitioners of medicine in its varied approaches to the care of health and the cure of disease. I speak, not from an expert's knowledge, but from a layman's observation. A few things, however, seem fairly obvious.

First, under adequate medical statesmanship, the private practitioners of medicine will excel industries, insurance companies, and governments in their zeal for the promotion of preventive medicine. That is to say, the private practitioners of medicine will deliberately set out to educate their clientele to look to physicians primarily for the care of health rather than for the cure of disease. Unfortunately, the American people still look upon doctors mainly as experts to be called in emergencies. On account of this shortsightedness of the American people, doctors actually have a vested interest in ill health instead of a vested interest in good health. The prevailing attitude of the people toward doctors actually puts a premium upon disease rather than upon health. In the main, doctors still secure their income from curing sick folk, not from advising well folk how to keep well. The tendency toward retaining doctors as health advisers is growing, but it is still a tiny tendency that affects the total health problem only slightly.

Do not misunderstand me. No one in America recognizes more fully the wasteful insanity of making doctors healers of disease rather than protectors of health than does the doctor himself. But until the American people are educated out of an attitude that obliges doctors to make the major part of their income from attending cases of sickness, our only hope of a healthier nation, unless we are to go over bag and baggage to state medicine, lies with the unselfish doctor who will consciously reduce his income by foisting upon sick patients health advice that may keep them from falling sick again. And, mark you, he must usually give this preventive advice as a side issue to medical attention, which means giving it to a sick patient whose mind, at the moment, is more upon his immediate plight than upon the future regulation of his habits. The doctors are not to blame one-tenth as much as the people are. Despite the health agitations of enlightened self-interest and social insight, our national motto seems to be: Millions for pills, but not one cent for prevention!

If the American mind could be so changed that the average American would look to his doctor for the care of health rather than for the cure of disease, a wholly new order could be established in the world of medicine. Into the fascinating details of the profound changes that could, in the light of such an attitude, be made in the practice of medicine I shall not now undertake to go. I shall content myself with suggesting that this change in attitude toward doctors can be brought about only in one or the other of two ways. First, it can be brought about as a result of a

deliberately organized and persistently promoted nation-wide educational campaign on the part of the private practitioners of medicine to change the attitude of their clientele toward doctors, to induce the American people, as I have said, to look to doctors for the care of health more than for the cure of disease. Second, it can be brought about by a vast high-powered machine of state medicine or its equivalent.

This transformation of attitude toward doctors is bound to come. It lies with the doctors themselves to say by which way it shall come. If the medical profession does not display adequate sensitiveness to social values and adequate statesmanship in meeting social issues, and itself lead and administer this transformation, it will inevitably be led and administered by industries, insurance companies, and governments.

Second, under adequate medical statesmanship, in such states as do not have great cities in which the sheer volume of work to be done develops great hospitals and draws together great practitioners of the varied arts and sciences of medicine, the private practitioners of medicine will foster rather than fight the development of state-supported medical and hospital centers where the rank and file of men engaged in the daily practice of medicine may keep constantly in touch with the latest results of research, where they may periodically refresh their knowledge and perfect their technique through lectures and clinics, and where they may find an extent of equipment and an expertness of assistance which the average practitioner may not be able himself to afford or to administer. In such states, adequate medical statesmanship will create and sustain such centers of training, research, and assistance for the further reason that the very existence of such centers of scientific medicine will give to the whole medical profession of the state and to its clientele a psychological sense of assurance that any emergency may be met without having to cross the continent—all such centers being developed as supplements to, not substitutes for, the practicing medical profession of the state.

Third, under adequate medical statesmanship, the rank and file of private practitioners of medicine will see to it that the medicine of the future swings neither to the extreme of an unscientific art of medicine nor to the extreme of an inartistic science of medicine. If, in his rôle of liaison officer between science and suffering, the doctor can effect a happy union of the science of medicine with the art of medicine, he will be meeting and mastering, in his field, the dominant issue of our time, which is: How can we make science and its myriad specialisms the servant rather than the exploiter of mankind? In his fusion of art and science in the field of medicine, the doctor will be making a major contribution to that humanization of science upon which, more than all else, the continuity and quality of western civilization depends. He will be helping to naturalize the social and philanthropic urge in a scientific age. How difficult, as well as desirable, this enterprise is, I can best emphasize by trying to reconstruct a conversation to which I was a party some years ago.

When I was editor of the *Century Magazine*, I had a friend who lived around the corner and dropped into my library now and then for a talk. He was a merchant of menaces. He was forever pursued by some peril. One night he came to me greatly disturbed by what seemed to him the menace of science.

"Science," he said to me, "is curing and clothing our bodies, but it is killing our souls."

"How?" I asked.

"Well, it's this way," he said. "You see, we aren't guinea-pigs or chemicals in a test tube. We're human beings. And that's what the modern scientists have forgotten. They've lost the human touch. They've become cold, cruel, and impersonal. It wouldn't matter so much if they stuck to their guinea-pigs and their test tubes, but lately they have begun to swarm out of their laboratories and to meddle with all sorts of human problems. And every time they touch a human value they blight it. They are laying their unholy hands on religion, on politics, on education, and even on the sacred relations of the home. Biologists, psychologists, and ethnologists are now presuming to tell us how to raise our families, run our governments, conduct our schools, and reform our churches. And you're guilty of having aided and abetted them by opening the pages of the *Century Magazine* to some of them."

He mentioned J. B. S. Haldane, Bertrand Russell, F. C. S. Schiller, and a dozen others.

"These men," he went on to say, "illustrate the grave danger of approaching human problems from the point of view of modern science. They're cold, cruel, and impersonal. I tell you, you can't handle the human problems of the church and the school and the home without sympathy, tenderness, and love. And these are the things that modern science is killing."

"Go on," I urged.

"See what would happen," he said, "if we allowed the scientists to dictate our affairs. The

psychologists, with their mental tests, would grade our children as if they were apples from the orchard or corn from the field. When they had found those they thought were culls, they would deny to them all educational opportunity except a little manual training or something of that sort. The ethnologists would herd all of us into a series of racial pens, as if we were Holsteins or Poland Chinas on a stock farm, and stir up all sorts of jealousy between the inmates of the Nordic pen and the Alpine pen and the Mediterranean pen. And there are the biologists. They're the most dangerous of the whole lot."

His special dislike of the biologists interested me, and I asked him for details.

"The biologists," he said, "would like to have us go back to barbarism and let natural selection weed out all the weaklings, so the race as a whole could grow strong. The biologists don't give a continental for the individual human being. They care only for the race, and their care for the race means cruelty to the individual human beings that happen not to measure up to their notion of a first-class man. Biology simply kills sympathy and tenderness and love in the man who follows it."

"Be a little more specific," I urged.

"Why, haven't you noticed the way the biologists sneer at charity? Science has simply killed in them the ability to appreciate the humane motives that sustain the vast philanthropic and social enterprises which, as I see it, prove that we are growing more civilized, that we are displaying sympathy, tenderness, and love for the unfortunates. The biologists tell us that our charity keeps alive an incredible number of persons who ought to be dead. And they say that the result of keeping these people alive is a deterioration of the whole race. They say frankly that charity is setting a premium on sick bodies and blundering minds and actually subsidizing shiftlessness. Don't you see the inhumanity of their position? If we follow the biologists, we shall have to let our weak bodied and weak minded babies die, sterilize and stigmatize our diseased, and, if we are logical, chloroform our old folk who might produce weak babies or weak ideas that would retard the progress of the race."

There was nothing to be gained by allowing him to go on. He had stripped his sentimental mind naked. It seems to me that he and his sort completely misinterpret the motive and misunderstand the method of the authentic scientist is dealing with human and social issues.

"I venture to suggest that you are wrong," I said to him, "all wrong, from start to finish. You are wrong in saying that science makes a man less sympathetic and tender in his consideration of the unfortunate. And you are wrong in saying that the biologist's program of race improvement means a cold, cruel, and impersonal treatment of the individual human being. On the contrary, it seems to me that science is laying the foundations for a new tenderness, a deeper understanding, and a more fruitful sympathy than sentimentality has ever produced. If I were an unfortunate, I would rather trust my fate in the hands of a really informed scientist than in the hands of a merely public spirited philanthropist. Just because he would understand my plight better, the scientist would deal with me in a more genuinely sympathetic spirit. And I believe that the most humane undertaking of our time is a statesmanlike program for race improvement."

"The new tenderness of science! Ha!" he exclaimed. "Are you trying to be humorous?"

I could see that although he dealt almost entirely in generalizations of the widest sweep, generalizations would never convince him. I attempted specific illustration.

"Suppose," I said, "that you are boarding a street car. The street car is manned by a slow witted conductor, a man against whom the cards of both heredity and environment have been stacked, a man badly born and badly reared. He lacks that grace of temper that well born and well reared folk display. He is a congenital grouch. He slams the door unceremoniously on your foot. And, just to add to the pleasantness of the proceeding, he starts the car with a sudden jerk that sends you sprawling on the floor of the platform of the car before you have had time to extract your imprisoned foot from the door. Now, I suggest that if you really know what modern science has to say about that conductor, if you know what biology and psychology have to say about such badly born and badly reared folk, you are in a better position to deal sympathetically and understandingly with that incident than if you had only a fund of general sweetness and sympathy upon which to draw. The scientist will realize the vast impersonal forces of heredity and environment that have made the conductor the grouch that he is. You condemn modern science for being impersonal, but here is an instance in which only an intelligently impersonal consideration can produce tenderness and sympathy. And, just in passing, I should like to say that many of the most public spirited men I know, men who give all sorts of time and money to philanthropic causes, are the most severe, unreasonable, and unsympathetic men I know

in their relation to their servants and to cases of individual need. I would be willing to wager that research would show a higher average of considerate sympathy among modern scientists than among modern sentimentalists."

"That's your guess," he said, "but the fact remains that all of the proposals of the biologists and eugenicists for race improvement are cold, cruel, and impersonal in that they say that charity does more harm than good. What would they have us do? Should we let our poor unfortunates starve and freeze just to get the unfit out of the way and to leave the world to the fit? Shall we turn the world into a vast breeding farm for thoroughbreds? What will become of the human values that we have come to associate with civilization?"

"The trouble seems to me to be," I suggested, "that the philanthropists and the scientists too often fight each other when they should collaborate. And that is just what the real scientists are working toward. Of course a few camp followers of science, who have picked up a few points of modern biology and missed its spirit, are suggesting the sort of inhuman things you say. But they, along with you, are missing the whole point of the authentic scientist's attitude toward charity. The authentic scientist knows that, while the philanthropist who pitches biology overboard becomes a futilitarian, the biologist who pitches philanthropy overboard becomes a brutalitarian. It is only when a man joins the technique of the laboratory with the temper of love that he becomes a social statesman. And that, I submit, is precisely what the authentic scientist is striving to do. You are judging modern science by a few merry-andrews, mountebanks, and charlatans who have stolen the patter of the laboratory in order to give an air of importance to their sensational journalism. You have, I think, completely misread the biologist's attitude toward philanthropy. But maybe the biologists are a bit to blame. Maybe they haven't taken enough care to see to it that we laymen understand them. Some distinguished biologist should write a little book to explain just what place tenderness and sympathy and love have in the great adventure of race improvement."

"I am afraid the trouble would be," he said, "that you couldn't find a biologist who thinks charity has any place in what he would call social statesmanship."

"Again, I am sure you're wrong," I said. "I am sure that any really great biologist would say two things about charity. First, I think he would recognize that sympathy, tenderness, love, and their attendant amenities are qualities that belong to first class men and women. And he would not be so blind as to miss the point that any eugenic program would defeat its own end if it began by crushing out of the first class men and women these qualities of sympathy and tenderness and love that they now display in their charities. Any such heartless program would set up forces of tradition and social heredity that would in time rob the superiors of these very important qualities of superiority. A great biologist, despite some of the swashbucklers in the lunatic fringe of the biological fraternity, will never counsel us to let our unfortunates starve and freeze. He knows that a man who hasn't enough sympathy to respond to the needs of an individual human being cannot be counted upon to respond to the needs of a whole race. As someone has remarked, men who will not respond to hygienics are not very likely to respond to eugenics.

"The biologist is not asking us to stop our charity. He is only asking us to rationalize our charity. The spirit of modern science, unless I misread it, tells us to go on taking care of our unfortunates, but it asks us to set in motion forces of enlightenment and to use every legitimate device for seeing to it that these unfit and unfortunate do not go on outbreeding the fit and the fortunate, as they are doing today. The spirit of modern science simply wants us to see the folly of an unintelligent coddling of the unfit in a manner that will make certain that our children, with a diminishing birth rate in their families, will have to take care of an ever increasing number of unfit. For if we do not make science the ally of our social service, by the sheer mathematics of the case a time will come when there will not be enough fit to take care of the unfit. And then we may realize that our unintelligent sympathy has turned out to be the most cruel thing in the world."

I am sure I did not convince my friend, but at least he helped me to clarify my own mind regarding the crucial importance of humanizing the application of the results of scientific research. It is just this humanization of science, this marriage of scientific procedure and social passion, that the doctor, who is at once scientist and artist, effects.

And now may I end by saying how sinfully I envy you who tonight prove, by your entrance into the Fellowship of the American College of Surgeons, that you have in some distinguished sense answered the high challenge of your pro-

fession? No other profession makes quite so many demands upon a man in the way of richness of personality, breadth of intellectual interests, catholicity of sympathy, and expertness in the techniques of human relationships. Aside from the demand for scientific knowledge of disease and its cure that the medical profession makes upon the doctor, there are other demands that might well discourage any man from entering practice.

The great doctor must know almost as much about the social order as the sociologist. This is necessary because the varied forces—political, social, economic, industrial, educational, religious—that march across a nation, making its mind or marring its spirit, register their effects in the lives of the doctor's patients. The more the doctor knows about these forces that make the atmosphere in which men's minds and bodies live, the more intelligently can he trace effects to their causes, and the more wisely can he counsel his patients.

The great doctor must know almost as much about the mind as the psychologist. This is necessary because even the most materialistic scientist admits that there is a subtle relationship between mind and body that the doctor of the body dare not overlook, for when he does overlook this relationship a thousand quacks rush in to capitalize his oversight.

The great doctor must know as much about the subtle art of counselling as the priest.

The great doctor must refuse to be party to the ironic paradox of commercializing a profession just when the professionalization of commerce begins to dawn.

The great doctor must decline to tear his specialism out of the living texture of the whole medical fabric. He will not allow the noble science of surgery, for instance, to degenerate into a merely higher carpentry.

And, finally, the great doctor must be able to distinguish between Hippocratic ethics and hypocritic etiquette in matters professional.

CONFERENCE ON TRAUMATIC SURGERY

OPENING REMARKS[1]

FREDERIC A. BESLEY, M.D., F.A.C.S., WAUKEGAN, ILLINOIS
Chairman, Board on Traumatic Surgery

THIS is the third meeting which has been conducted by the Board on Traumatic Surgery of the American College of Surgeons to consider the principles involved in, and to exchange thoughts and ideas relative to, the absorbing subject of traumatic surgery or the care of the injured. The first meeting was held at Detroit and the second at Boston.

In preparing the program that is to be presented today no difficulty was experienced in securing men interested in both the scientific and the economic sides of the question to participate. The keen interest that has been shown implies a common bond of sympathy and a unity of purpose in securing better medical and surgical care of the injured.

During the past three years the efforts and activities of the Board on Traumatic Surgery have been directed toward the building of a firm and substantial foundation of education regarding all phases of this intricate situation, and today at this meeting it is hoped and believed that the corner stone will be laid for an enduring superstructure which will furnish resources for the practical and the actual achievement of better care for the injured, for we are not yet so thoroughly informed but that further information is welcome and desirable.

Obviously, this building involves the correlation of many interests and circumstances which, fortunately, do not conflict and it is believed that today's discussion can be successful in bringing to a fruitful issue the practical improvement in all departments of traumatic surgery.

ACTIVITIES OF THE BOARD ON TRAUMATIC SURGERY[1]

BOWMAN C. CROWELL, M.D., CHICAGO
Secretary, Board on Traumatic Surgery

DURING 1926 the Board of Regents appointed a Committee on Traumatic Surgery and a Research Group of this Committee to study the question of improvement of the care of the injured. This Research Group made a report to the Committee, and the Committee made certain recommendations to the Board of Regents of the College on October 26, 1926, in which was established a Minimum Standard pertaining to the practice of traumatic surgery. This standard was adopted by the Regents. At this time a Board on Traumatic Surgery was appointed for the purpose of carrying on these studies and making recommendations to the Board of Regents, with a view to improving service in the field of traumatic surgery. Since that time the Board, through the central office of the Department of Clinical Research, has been actively pursuing this subject. Its activities have been along several lines.

SURVEYS

In order that the Board on Traumatic Surgery might have first hand information, and make its own study of the practice of traumatic surgery without bias or prejudice which might arise from information obtained from any of the parties interested in the care of the injured, a series of surveys of actual conditions has been carried out. This has been done with the object in view also of arriving at definite conclusions as to the important points in which there exist deficiencies in the care of the injured. Only with such information can a rational program for improvement of the care of the injured be formulated.

[1] Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October, 14-18, 1929.

With these ideas in view, the Board, through an especially appointed agent working under the direction of the chairman and the secretary of the Board on Traumatic Surgery and guided by the Director-General has made surveys of conditions in the Oklahoma oil fields, in the city of New York, and in Chicago. These surveys include a study of the question with relation to the competency and efficiency of all parties interested in the care of the injured. The program of the Board will be based in part upon the results of these surveys, summaries of which have been published in the *Bulletins* of the College for June and September, 1929.

MEDICAL EDUCATION

It was realized that all real progress in the care of the injured depends upon improvement in the teaching of this subject and in emphasis placed upon it in the curricula of the medical schools, with postgraduate courses as well. At the instigation of the Board on Traumatic Surgery this subject was presented at the 1928 meeting of the American Association of Medical Colleges held at Indianapolis, and a committee of that organization has been appointed, whose duty it is to see that emphasis is placed upon the teaching of the subject of traumatic surgery in the curricula of the surgical departments of the medical schools. The future influence that this will have cannot be overemphasized.

LIST OF APPROVED TRAUMATIC SURGEONS

It is realized by the Board that a degree in medicine or a state license to practice medicine does not indicate competency in major traumatic surgery. An attempt is being made by the Board to form a list of competent traumatic surgeons throughout the United States. Information concerning these surgeons is obtained from numerous sources and is being accumulated at the College and indexed on cards. Some thousands of these cards have already been prepared, as an initial step in the preparation of a list of those who eventually may be recognized by the College from the standpoint of competency to practice traumatic surgery.

CONTACTS

The Board on Traumatic Surgery has been in intimate contact with groups of all agencies interested in the care of the injured, namely: practicing surgeons, compensation carriers, employers of labor, employees, industrial medical clinics, compensation commissions, hospitals, hospital clinics, and organizations of the medical profession interested in traumatic surgery.

SECTIONAL MEETINGS

Sectional meetings of the College have been held in a large number of the states of the Union and in Canada. These meetings occupy two days of discussion on scientific subjects, hospital programs, and a public meeting. At all of these, some phase of traumatic surgery has been the subject of discussion. Personal contacts by members of the Board with local men in the various states have been established and an interested co-operation has been secured from these men who have been made familiar with the activities of the College in reference to traumatic surgery.

DEPARTMENT OF HOSPITAL ACTIVITIES

The Department of Hospital Activities of the American College of Surgeons is in daily contact with about 3,000 hospitals of twenty-five beds and over, in the United States and Canada; and 1,919 of these hospitals appear on the approved list of the American College of Surgeons. All of these have been made familiar with the work of the Board on Traumatic Surgery, and advice has been furnished to them as to methods pertaining to organization and equipment for improved care of the injured. The value of the co-operation of this Department with the work of the Board on Traumatic Surgery cannot be overestimated on account of its intimate personal contact with hospital administrators, hospital trustees, and surgeons.

CONCLUSION

The activities of the Board, up to the present time, have been of an educational, formative, and research character—seeking for a firm foundation for its more definite constructive program. Some phases of the constructive program have already been outlined and put into effect.

A "Standard for Medical Service" has been evolved and is being perfected to be required of industries, hospitals, indemnity carriers, and others desiring recognition and approval by the American College of Surgeons.

THE RELATION OF THE SURGEON TO THE INDEMNITY COMPANY[1]

FREDERICK W. SLOBE, M.D., CHICAGO
Secretary, Chicago Society of Industrial Medicine and Surgery

ANY study of the relation between the surgeon and the indemnity company should be based on the influence such relationship has on the patient's welfare. We must continually keep in mind our common obligation, namely, the relief, cure, and rehabilitation of the injured in the shortest possible time. Everything else must be subservient to that purpose. Although several economic commercial trends are a vicious menace at times, we must not allow our attention to be distracted; by steadfastly keeping the patient's welfare as our objective, many of the disquieting tendencies of commercialism will be overthrown by the sheer force and irresistible appeal of conscientious, efficient service.

There are certain factors and tendencies in the relation between indemnity company and surgeon which have a definite effect on the quality of service to the injured and which, therefore, merit close consideration.

It is not difficult to ascertain that the patient is bound to suffer from the unfortunate practice of price-cutting. When voluntarily practiced by the surgeon, it is usually indicative of a subterfuge to cover up incompetence. When insisted upon by indemnity companies, it indicates a lack of realization that the cost per visit means little as compared with the total bill; that the total bill is of little significance as compared with the result obtained; that cheap rates when matched up with poor results are most costly; and that bargaining for surgeons usually defeats its own purpose. Such tendencies do not lodge the patient in the best hands and an inferior grade of service results.

Quite similarly, a very deterrent effect upon the patient's welfare arises from the adoption of indiscriminate contracts. When based upon a percentage of the premium, the surgeon literally gambles with the insurance company; his remuneration is almost invariably so absurdly low that, becoming disgruntled, he finds it difficult to enter into his work with that requisite spirit and keen interest so essential in stimulating his best efforts. Injuries come to be viewed in the aggregate as part of a factory's hazard instead of each patient being studied as an individual problem.

The injured employee is not a commodity but a vital organism quick to react unfavorably to any economic trend which affects his surgical care adversely. Hence, both his immediate and ultimate welfare are jeopardized unless the surgeon receives adequate remuneration for services performed. This danger is eliminated if the surgeon is paid on a fee basis; he is then compensated for what he does—no more and no less.

During the past year we have experimented with several contracts and it is our firm conviction that contract practice is usually prejudicial to the best type of service, that the surgeon is almost invariably underpaid, and that the field of traumatic surgery would be gradually undermined thereby. This may not apply, however, to certain salary arrangements provided the remuneration is adequate.

Another great factor influencing the quality of the patient's treatment lies in the relation between the local surgeon and the indemnity company's medical department with its chief surgeon. If the patient is to receive intelligent consideration by the insurance company, it is most essential that its medical department be independent with full authority in handling all strictly medical situations. The chief surgeon, as well as being a recognized leader in traumatic surgery, should be a man of human understanding and diplomacy. All of the local, district surgeons should be selected by him instead of by the non-medical claim department. The basis of such appointment should not be the fee per dressing, or the fallacious system of statistical average costs of bills, but rather the surgeon's ability, training, honesty, and judgment. The chief surgeon is entitled to be the head of the entire medical organization instead of merely the claim department's consultant. The district surgeon then becomes a part of a medical system instead of a pawn in the hands of a claim man.

The entire medical department of an indemnity company should be of such high caliber as to inspire the confidence of the local surgeons. The patient's prospects are not bettered unless the indemnity company's medical department has something superior to offer.

The fixed policy followed by some companies in insisting that all hospital patients and all ambulatory office patients who are not working be referred to the chief surgeon, is an experiment with such far-reaching results that it merits

[1] Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

the most careful study before premature adoption. If we were concerned only with the care of those injuries readily recognizable as serious when first seen, our problem would be confined to adequate first aid and immediate transportation to a qualified surgeon in an efficient hospital. When we consider the total number of industrial accidents, however, the serious, urgent emergencies are found to be rather rare and for economic reasons nearly all of the less serious injuries require treatment in relatively close proximity to the place of employment. And what of that vast volume of injuries less serious originally, in which subsequent and often serious complications develop? Each injury has the potentiality of danger no matter how trivial originally. We know that the primary treatment during the first day or week often determines the final result; what disastrous results often follow failure to recognize promptly a skull fracture with latent symptoms, a perforated viscus from an abdominal injury, or a deep-seated hand infection.

How important, therefore, is the local traumatic surgeon and how essential that he be of good training, demonstrated ability, sound judgment, and integrity. For in him is vested the responsibility for the care of a huge majority of the injuries in industry, 90 per cent of which must be treated in the vicinity of the factory. He determines the primary diagnosis and mode of treatment, and watches carefully for subsequent complications. Open reduction of fractures and operation for skull fracture are rarely indicated in proportion to the total number of fractures and head injuries which the local surgeon sees, but the stiff joints, lame backs, results of infection, and numerous other conditions cause functional impairment and lost time which run into a huge total.

It is fundamentally essential, therefore, that intelligent, skillful care be immediately available to the patient in the district in which he works. Careful selection of the local surgeon is necessary to guarantee such care. Chosen as the result of this selection, the local surgeon should not be hesitant to seek consultation and should be glad to receive constructive criticism. But he rightfully expects the privilege of assuming responsibility in proportion to his ability.

The injured patient's welfare, individually and collectively—in the present and in the future—always will be closely linked with the quality of traumatic surgery; to elevate the status of this branch of surgery, it must become increasingly attractive to the best type of future doctors; and to attract this desired type, competence and ability must be recognized.

The conclusion is obvious: the arbitrary practice adopted by some indemnity companies of indiscriminately taking over patients irrespective of the local surgeon's ability is open to just criticism when we carefully scrutinize all of the factors affecting the present and future welfare of the injured. This procedure is unnecessary if the following fundamental principle is closely adhered to, namely: that the responsibility for the care of the injured from the very beginning until discharge be restricted to the competent. This applies alike to local surgeon, consulting specialist, and chief surgeon. Under such conditions the patient's welfare is safeguarded. To accomplish it will require much education of indemnity companies, employer corporations, surgeons, and the public. But the increasing recognition of the importance of the crippling casualties in industrial and civil life, and the public's sense of deep obligation to the injured employees who are given practically no jurisdiction as to the type of care they receive, will be powerful factors in improving the quality of traumatic surgery and in guiding the injured into the hands of those surgeons qualified to insure efficient service.

PRESENT STATUS AND QUALIFICATIONS OF THE INDUSTRIAL SURGEON[1]

C. F. N. SCHRAM, M.D., BELOIT, WISCONSIN
President, American Association of Industrial Physicians and Surgeons

THE present status of the industrial surgeon depends entirely upon the point of view. Some of those inside the medical profession regard us as unfair competitors, some as merely too lazy to work up a private practice, and some regard us as merely lucky. The impression seems to be that we get a big salary with no office, collection, secretarial, or other expenses which are usual in the practice of medicine, and it is probably this latter feature that is uppermost in the minds of those who consider our status lucky.

As to our being lazy—well, a lazy man is a lazy man but I do not believe there is a lazy job. One may be lazy and slothful on any job and I know that some medically trained lazy men have for short periods held down a chair (borrowing a phrase from our universities) in industry, but the competition is too strong, the dissemination of knowledge along medical and surgical lines too great for the managers of industry to countenance for long the employment of a lazy physician. I know of none in the American Association of Industrial Physicians and Surgeons.

Unfair competitor—rather a unique appellation, which is never applied to ourselves, but without inquiring into the details or circumstances surrounding any given case or cases it can be applied to the other fellow with impunity and the physicians and surgeons in industry, because of their special position in the surgical field and because of a feeling of apprehensiveness in regard to the future economic stability of the practice of medicine, have frequently been accused of disobeying this tenet of the ethical code.

I just referred to the field of medicine and surgery as being economically unsound. This applies, as I see it, to the great bulk of the practice of medicine as it is carried on today by the general practitioners. The indications of this economic unrest are made manifest almost daily in the daily press, the medical journals, and the trade magazines, through editorials and syndicated news articles in regard to state medicine, pay clinics, university hospitals, and so-called endowed research laboratories. The reason for this agitation is not hard to find. The cost of sickness has increased until there is an economic demand for a lowering of these costs. The physician has not been the gainer to any marked extent in this increasing cost of sickness but he has received the discredit for it. Generally speaking the physician has not responded to this adverse criticism by solving the problem of increasing cost of sickness and I am not alone in my feeling that it is his job.

The shoe pinched when laymen attempted to solve this problem by endowing hospitals, clinics, and laboratories and when some industries employed medical and surgical staffs for the complete care of their employees, in a few instances extending this care to dependent members of their employees' families.

I have called attention to this economic aspect of the practice of medicine because I know that when things are unstable and when there is an attitude of dissatisfaction and apprehensiveness, we are quite prone to criticize. I presume that it is for this reason that the physician in industry has received his share of the adverse criticism.

One example will be enough to refute such an accusation. In a certain city an industry, employing a surgeon on full time, paid to local physicians, during the year 1928, $1,070.00. Hospital bills of employees or members of their families, $940.00 was guaranteed and $2,000.00 was loaned to employees on account of sickness, a goodly percentage of which went to pay physicians' bills. Besides this, 600 cases were referred directly to the local physicians. But at the request of the company this industrial surgeon had cared for during 1928, 46 cases of injury not occurring in employment. These 46 cases charged for at the regular rates would have amounted to $150.00. To repeat, this industry put out through the jurisdiction of this surgeon, $1,000.00 directly to ten different local physicians, loaned $3,000.00 more on account of sickness, and referred 600 patients to local physicians and surgeons, and the firm and the surgeon were severely criticized for their special interest in 46 minor cases.

The interest of employer in employee as portrayed by this illustration can and is being duplicated in almost every industry throughout the United States and Canada and it well demonstrates the importance which industrial leaders are placing upon the man-power in their shops today.

The industrial surgeon is less settled and sure of his position in the community than he would be

[1] Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

were he in private practice. There is not much advancement for him except in salary. The management may change, ideas may change, the business may be sold, slumps may come, and sometimes the industrial surgeon finds himself without a job or income. However, private practices have been lost and other physicians have been forced, due to circumstances, to break up pleasant associations and change locations and fields of activity and it would be strange if this did not occasionally happen to the surgeon in industry.

But this is enough of the pessimistic side. The real status of the industrial surgeon is exactly what he makes it. His status and success in industry depends upon his being able to sell himself, and his ability, to the people of that industry, both management and employees, and to work in harmony with them and his co-practitioners in that community. If he renders service, if he sells health, if he is everlastingly at it, I question industry's willingness to part with such a man. Sometimes we become so egotistic, so filled with a sense of our own importance that we do not see how industry can get along if we are not there to explain what a "cholecystitis" or a "nephritis" is. It is then that our status or relation to industry becomes warped and we do not give to the employer or to the employees our best service.

As to qualifications, the industrial surgeon must like industry and folks who work. He must enjoy working with the producers and builders in a nation of producers and builders. He must be able to think of production and waste in reference to his own department.

Time lost because of sickness or injury is waste. Healthy employees working full time means production. Production by the industrial surgeon is not men sick at home or in the hospital but in the shop under healthy working conditions. He must have knowledge of the healthy man and how to advise him to stay healthy. He will need the mechanical ability of a toolmaker for his fracture work. His training in surgery must be the very best, for his job is repair work and the lacerated injuries which come to him are infected and in the average factory of the metals trades, these are legion. In plain English, this industrial surgeon should have a better training than any of us physicians ever did have for he will need it all.

When an industry is going to build an engine, be it gas, steam, or crude oil, a corps of engineers is hired—an electrical engineer on the magneto, batteries and wiring; a mechanical engineer, an engineer on combustion; a metallurgist or chemical engineer—and all work on a piece of machinery that when complete a boy of grade school education can run. And let no one lead you to believe that industry picks out the mentally lame, halt, and blind when it goes out for these engineers. Industrial managers do not want, nor will they employ, the engineer whose general knowledge of the various branches of engineering is good. They want and get the man who knows one line and is a leader in that line and they are not concerned about the expense. They employ the most highly trained, the most scientific men to do, not a multiplicity of engineering feats, but rather just one and do it well. I know an engineer whose sole job is high speed work, another whose job is Diesel engine construction, confined entirely to heavy duty work, an electrical engineer who confines his duties to the making of magnetos. I could cite more examples but these are enough to demonstrate the point that industry is employing highly trained, skilled technicians to build a mechanical apparatus, and it would be the height of folly to suppose that these same employers would be lax in their selection of their industrial surgeon. This industrial surgeon must work with these highly educated and trained men, he must work with the management, and the majority of his patients come from the foundrymen, blacksmiths, the mechanics and the laborers who follow out the orders and ideas of the first two groups.

I have known instances of firms which wished to build and maintain a working force of the most complicated pieces of living mechanism that the world has ever produced and which secured engineers whose only qualification was their legal right to put the letters "M" and "D" after their name. When all industries apply the same test or comparable tests to their selection of men to head their engineering and their human maintenance departments they will get results because they will get qualified men. It is man-power that runs industry. Healthy man-power is efficient. If industry wants that and I believe it does, it will be repaid by investing in the best there is.

The status of the industrial surgeon is and will be measured by the service he gives; his qualifications by the results he obtains.

PRE-EMPLOYMENT AND PERIODIC HEALTH EXAMINATIONS IN INDUSTRY[1]

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THE physical examination of the prospective employee is, unfortunately, still looked upon by many executives, as well as by certain of the medical profession, as a means for making it possible in their respective industries to obtain labor that is going to be subject to the smallest amount of impaired production and absenteeism due to potential or active disease. It would seem that there are still to be found doctors and lay people who talk and think 100 per cent mechanistically. When the employer anticipates going out into the labor market, his state of mind with respect to his fellow beings who are going to contribute the labor is just the same as though he went into the machine shop to purchase machine equipment. We often hear the statement that man is a machine. In a sense this may be true, as we think of his physical operation. Nevertheless, in pinning the statement down to personalities, it is seldom that we find either executive or employee ready to be classified with lathes, punch presses, or screw making machines. The human body may work mechanically and chemically according to the several laws known regarding natural processes. But a human being taken out of the community and put into an industry is not in the same category with the machine. It is true that many of the activities of maintenance and operation of machines are duplicated in man; you can overhaul the human being and clean him outside as well as inside. He gets lubrication, fuel, and water. As a result, work is done. His contribution to the product or service may be computed fairly definitely in terms of energy, and consumers may be charged for it. But, again, I insist he is not entirely a machine—only in part are his activities machine-like.

A lathe, a punch press, or a screw making machine undergoes conditioning similar to that which maintains the human operative. The machines are cleaned, lubricated, have a source of energy applied, and thus do work, just as is the case with a human being. The analogy runs as a striking parallel throughout the entire story up to the question of replacement. The machine cannot of itself replace parts, while, in a measure, there is replacement in the human being. Neither does a planer or a stamping machine, no matter how long employed, ever own the business.

The living entity that is involved in this argument is a definite one and establishes the man as something apart and infinitely above the machine. The majority of human beings in the pursuit of life, liberty, and happiness, can obtain necessary remuneration only through work, and also they have a certain right to expect, as proceeds from this work, something beside food, clothing, and shelter. There are many of the good things of the world which lie just beyond the absolute necessities, and whose attainment can come about only through an increase in the character, extent, and refinement of the several phases of endeavor. Thus an available field lies at the door of all who can and will work.

When a man goes to an industry for work he generally goes because he needs a job and hopes that some job needs him, regardless of his physical qualifications. Industry does not approach the prospective employee with inducements of various kinds, unless the individual has something worth while to sell. The romancing formulator of the Declaration of Independence stated that all men were created free and equal. We know that this is true only in a measure. Unfortunately, environment, heredity, poor food, living habits, ignorance, and disease have forced upon a certain portion of our community bodily impairments for which, in the main, they cannot be held responsible. The sources of these impairments are no respecters of persons; they invade all grades of society; and, of course, it is manifest that employment in some form or other is necessary for the majority of persons. A part, at least, of the obligation to provide employment belongs to industry, because of its immediate or remote responsibility for the environmental conditions.

As medical science develops and becomes more exact in diagnosis and examination, we find that the physically perfect individual is fast becoming a rarity. We can generally uncover some physical fault in everyone. Thus it is that industry can never attain the place where it employs only the perfect man or perfect woman. It becomes a self-evident fact that we must accept for employment individuals with certain impairments. In the industrial world, there are various grades of physical requirements and into these certain individuals with impairments can and should be fitted.

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

The examination of the prospective employee then becomes a physical appraisal for the purpose of making it possible for industry to know the condition of the various new labor units which it brings within its walls and to place them suitably. This statement omits the unassailable declaration that industry should not employ individuals who through employment constitute a menace to themselves, to others, to property, or to service.

The physical examination of the prospective employee, it is to be hoped, when carried out at the hands of industry in a proper fashion, may become one of the most valuable of our public health and health maintenance agencies. As individuals are examined, and their several substandard factors uncovered and appraised, it is apparent that, if their physical condition does not preclude employment, there exists the potential urge to correct the ordinary impairments.

In a general discussion, no attempt should be made to classify the various types of impairments other than to say that they may be grouped as minor and major, and correctable and non-correctable. Properly, I believe, in any case the minor impairments should be acceptable under certain restrictions. The major correctable impairment is, as a rule, not a bar to employment in some capacity, while the major non-correctable one is worthy of much concern. Which impairments are included in the several groups, it is quite impossible to discuss within the time allotted to me. Classification varies with the industries involved and the requirements within these respective industries. I wish merely to make the point that, under proper influence of industrial supervision, it should be possible to make evident to accepted employees the real necessity for correction of all impairments that are correctable. It is highly probable that the common cold and most of the other upper respiratory infectious diseases owe either the power of their bacterial attack, or the lessening of the forces of resistance, to open focal avenues along either the breathing apparatus or the food tube.

When we consider that, included in the minor impairments, are most of the air passage and gastro-intestinal foci of infection and, further, when we consider the ease with which many of these foci are eradicated, or the bacterial flora inhibited or abolished, it is apparent at once that there is a vast field of justifiable preventive practice opened wherever medicine finds its proper place in industry. There is still a long way to go before we approach anything like the control of the correctable minor impairment question as it involves the respiratory or the gastro-intestinal apparatus. As for the major correctable impairment, we know that many of the anatomical as well as the physiological dyscrasias may, through the proper application of surgical or medical means, be partially or wholly overcome.

This leaves for consideration, then, the large class of persons who possess impairments that are non-correctable and of such type and degree that they are placed in the major category, and who, therefore, are often excluded from employment. Their impairments, while of a considerable degree of gravity, have at the benevolent hands of nature been so kindly adjusted in the phenomena of compensation that such persons still have, if properly treated, the possibilities of relatively long life and remunerative productiveness.

In this latter group may be mentioned impairments—such as cardiac, cardiovascular renal, post-tuberculous, chronic gastro-intestinal, metabolic, special sense, genito-urinary—also new-growths and impairments of the bones, joints, and skin.

To enumerate the specific types in each of the above mentioned groupings would require an elaboration not possible within the time limits of this paper. However, the case of cardiac impairment will serve as a fair illustration of the point of view taken with respect to employment of the individual with a major non-correctable impairment.

Probably no class is more often refused employment than that with valvular heart disease because, even in the incomplete physical appraisal that industry makes, the valvular murmur is at least a positive sign and one which the average examiner, with average hearing, can detect. In most instances applicants are rejected without regard to the type, transmission, or position of the murmur and quite generally without due regard to the signs of decompensation. We not infrequently see the vigorous looking, full blooded, well nourished individual, with a poor myocardium and impending decompensation, accepted for employment, while the thin, poorly nourished individual, with a distinct murmur at the apex, systolic in time, but with a good myocardium and no decompensation, is only too generally refused employment.

It is to be remembered that the physical examination of the prospective employee, for economic and administrative reasons, interjects into medical understanding a new conception of the physical examination. Primarily, the industry is in business for the purpose of producing a product or rendering a service to be sold at a profit. The medical element is only incidental and, while its public relations value, as well as its contribution

to the industry, is constantly being more appreciated by executives, nevertheless the element of cost enters rather largely into the organization of any plan for physical examination.

The pre-employment physical examination, then, is not a hospital or diagnostic clinic survey. Its final purpose is to determine whether an individual is employable under the conditions we have mentioned and to do so with the least possible expenditure of time and cost.

Aside from the advantage of the rejection of hazardous persons or of placement according to physical abilities, the initial pre-employment examination has no other function than to provide an urge for the correction of impairments. Once the industry is entered, if no further physical appraisal is made, a real opportunity along the lines of health conservation has been lost. To justify from all angles the pre-employment examination, it should be coupled with physical surveys at certain times in the course of the employment. Individuals with no discernible impairments should come under the schedule of the yearly health survey, whereas those with major or minor non-correctable impairments should submit themselves for examination at intervals to be determined by medical advice. As a result of the physical findings, it should be a simple matter to demonstrate the need of a consultation with the individual's medical adviser.

In the light of our present understanding, the care and correction of such impairments is not within the scope of the field of endeavor of the industry. The medical talent may be capable. Nevertheless, industry, since it is not in the business of practicing medicine, is not justified in adding to the cost of its product or service the cost of providing for adequate medical or surgical care of prospective employees or employees with minor or major correctable or non-correctable impairments. With respect to the correction of impairments, the medical department should act in the capacity of a clearing house of advice as to capable and adequate medical and surgical sources. In all instances in which advice is given with reference to medical, surgical, dental, or hospital care, opportunity for multiple choice should be insisted upon.

As a public relations activity and as an economic contribution, no greater good can be imagined than industry's co-operation in attempting the solution of the problem presented by the unfortunates who, because of the major nature of their impairments and for no other reason, are refused employment. Such institutions as the American Heart Association, the National Tuberculosis Association, the National Safety Council, the American College of Surgeons, and the American Medical Association have made and are making splendid contributions in their endeavor to find this solution, and thus far much has been accomplished. Nevertheless, industry and these publicly minded groups have a long way to go, not only in the education of their own medical personnel but in that of management. A sick man is rarely considered an asset, but a man who has been sick and recovered, even though with physical residues, who is co-operative, and who knows how to maintain health, is oftentimes a more reliable, loyal, and appreciative employee than the individual who has never been ill. As we consider the monumental contributions to society, literature, art, science, and music, we are astonished to find that in many instances they have been made by chronic invalids and frequently the greatest contributions have been made during their periods of extreme discomfort or even serious illness. The physically imperfect individual deserves and must have real consideration when he seeks industrial opportunities.

THE ORGANIZATION OF AN INDUSTRIAL MEDICAL DEPARTMENT[1]

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THE problem of organizing a medical department in large industries, those of 500 or more employees, is much easier of solution than the problem presented by small industries that cannot support a full time medical man. Because of this division of industrial medical work into two large classes it is impossible to cover the subject of organization with its many varying aspects in a short article such as this must necessarily be. We must therefore deal in generalities and with the fundamentals only of industrial medical service.

Why should there be an organized medical department in any industry? Have not the general practitioners and the general surgeons contended that there is no such thing as industrial medicine and surgery? Have they not argued, and are still arguing, that they can do the work of the industrial physician just as efficiently as he? That industrial surgery is traumatic surgery and any good general surgeon can do traumatic surgery?

That any good surgeon can do traumatic surgery, even industrial traumatic surgery, we shall not deny, but traumatic surgery constitutes not more than one-third of the work that an industrial surgeon is called upon to perform, so upon whom can industry depend for the performance of the other two-thirds? Not upon the general practitioner who has had little or no experience or training in the five other fundamentals of an industrial health service but upon the industrial physician who has had both training and experience in the medical and non-medical requirements of his position. Then again, of two men whose education and technical ability are equal, is not the one whose work is one-third traumatic surgery better qualified to do it than the one who sees only an occasional case?

Before we can intelligently plan or organize anything we must know what its object is to be, what function it is to perform, and what its purpose is.

What is the object of an industrial medical department? Health service to the employee, and under this broad term is included the care of the industrially injured. What function is it to perform? To supervise and care for the health of the employee. What is its purpose? Humanitarian? Yes, by all means should the humanizing element be its guiding influence. Utilitarian? Yes, in the sense of usefulness, otherwise it cannot perform its highest function of service. Economic? Yes, although this is usually hard to demonstrate to the satisfaction of industry's executives. Philanthropic? No! at least not in the present day sense of the word which conveys the idea of organized charity. Altruistic? Yes! It never should be actuated by sordid motives. Paternalistic? Emphatically, no! An industrial medical department should never usurp the functions nor transgress the prerogatives of the general practitioner. It should never tend to pauperize but rather by education and friendly (fraternal) advice, assist the employee to help himself in all matters pertaining to health.

When an industry has decided that there is a need for health service in its organization, the first and most important task is to secure a capable physician to direct the work; to make a survey of the plant to ascertain its specific health hazards and its essential health needs; and then to submit a plan with recommendations for meeting that particular industry's health requirements to an executive who has general authority over the entire industry. The work and plan of the medical department should never be hampered by being placed directly or indirectly under the control of a layman who is the head of a department whose activities are actuated by purely mercenary motives; it should thoroughly cooperate with but never, in any way, be subservient to the casualty or insurance department. As the scope of a medical department's work is general and co-operative with all other departments in the organization, the medical officer should be responsible only to an executive with general authority.

In choosing a physician to serve as medical director, employers should exercise the same care as used in selecting a man for any other important technical position in their organization. They should not assume that physicians, just because they are physicians, are thereby qualified to organize or direct an industrial medical department. As the value of such a department depends primarily upon the doctor's ability to inspire confidence, he should be selected with more consideration of his personality than of his professional competency but this also should be of the highest order. Adequate salary, so rare in industrial medical departments, should be paid in

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

order to attract a high class man. It should be no less than that of the chief counsel, chief engineer, chief chemist or the chief of any of the other technical departments. The conservation of the machine-power is considered good business management and is supervised by a high salaried official. The conservation of the man-power that runs the machines should be of paramount importance. Mr. Magnus W. Alexander, managing director, National Industrial Conference Board, says: "The Management which follows the short-sighted policy of employing the medical man it can obtain most cheaply, is sure to get as much ability and professional skill as it is willing to pay for and no more; and it may even find that by such a policy it has done more harm than good. In industrial work second rate physicians are a menace as great as, or even greater than are second rate executives of any other type."

The medical department of an industry is, almost without exception, an index of the economic value the management places upon health service rather than what the medical officer desires it to be. If better medical service is desired in industry it is not so much a problem of the *physician* in industry as it is of the educating of the *management* to the value of such a service. Many large industries have already proved that the more extensive the health service rendered the better it pays.

A complete health service program for an industrial medical department consists of:

1. The care of industrial injuries. This is the primary function of all industrial medical departments and is the only activity they have in common in large and small plants.

2. The examination of applicants for employment or employees transferred within the plant, not for the purpose of rejection but as a means for selective placement.

3. Preventive medicine as featured by the consideration of problems of plant hygiene and sanitation, including particular observation of groups of workers exposed to specific hazards.

4. Frequent examination of workers known to be sub-standard or in need of medical supervision, and the periodic examination of all other employees at least once a year.

5. The education of workers in matters pertaining to health.

6. The guidance of workers in securing necessary and competent medical service, both diagnostic and remedial.

Upon the management will rest the responsibility for determining the scope of the work to be instituted by the medical department. This in a great measure will depend upon the size of the industry. If treatment of industrial injuries was the end of industrial medical service, standards of personnel could be fixed with accident frequency and severity rates as the basis to work upon. But there are the other activities, previously mentioned, some of almost as great importance, and the more of them the medical department undertakes, the larger the personnel must be. In an industry of 500 employees a complete health program would require the full time service of an industrial physician and with the addition of a nurse 1,000 employees could be efficiently supervised.

Shall the personnel of the medical department be upon a full time or part time basis? This is a question upon which there is a diversity of opinion. A combination of a full-time medical director with part time medical assistants offers a satisfactory arrangement in plants of sufficient size to warrant a complete medical health service. This plan assures, at the same time, medical service of a high quality and adequate administrative supervision. Detached medical service, as in use in small industries is, with rare exceptions, purely a surgical service. Obviously the employer who desires a broader range of medical service, to include physical examinations, etc., must regularly employ a physician upon either a part or whole time basis depending upon the scope of activities desired.

The number of physicians and nurses making up the personnel of an industrial medical department must vary with the size of the plant and the scope of the medical activities desired by the management. The quality and character of this personnel should never vary and should always be of the highest type.

To specialize in industrial medicine requires a knowledge of certain social, economic and administrative problems related to industry that are not in the medical curriculum. Many physicians think that industrial medicine and surgery is nothing more than traumatic surgery and consists entirely of the treatment and care of injuries and requires no special training or knowledge other than that acquired by the general practitioner in obtaining his degree. Traumatic surgery constitutes only about one-third of industrial medical work in those industries that have a complete health service. Its proportion is larger in the smaller industries. The difference between a physician in general practice and an industrial physician consists of the latter's appreciation of the problems of industry and the application of the art and science of medicine and surgery to

those problems. There can be no doubt that such a difference exists and the claim of the physician in industry to being a specialist is not based upon his possession of any peculiar medical knowledge but chiefly upon his knowledge of non-medical things.

In common with all other physicians, he should possess a good education, honesty, tact and judgment, a thorough training in the fundamentals of his profession, and a hospital service of not less than 2 years. Along with these he should also have had several years of general practice in which he maintained a close connection with public health agencies and studied preventive medicine, community health problems, and activities or in lieu of this a special course covering these subjects. He must have a general knowledge of industrial relations including employment methods; labor turnover, job analysis, apprenticeship, pensions, insurance, rest periods, absenteeism and welfare problems, and a working knowledge of the workmen's compensation law of his own state and of other states also if his industry is national in scope. Other essential qualifications are a thorough knowledge of working conditions and their influence upon the health of the worker, of occupational diseases, accident prevention, heating, lighting, ventilation, water supply, housing conditions, and community health problems. Thus we find that the industrial physician combines with his medical knowledge and experience certain other attributes peculiar to the sanitary engineer, safety engineer, employment manager, and community health officer. It is the lack of this knowledge which handicaps the new medical man coming into the industrial field; it is the lack of this knowledge which makes it impossible for the general practitioner or general surgeon to do the industrial physician's job as effectively as he himself is able to do it. It isn't every physician that can make a success of industrial medicine. Many young men enter it thinking it an easy way to make a living but they soon drop out when they realize or are forced to realize that their unpreparedness and lack of special knowledge of industrial problems makes it impossible for them to occupy any other than a very minor position in the industrial medical field.

I am convinced that the successful industrial physician, like a poet, is born and not made. He must be endowed with that certain peculiar attribute, mostly inherent and partially the result of environment, that we call personality. A personality that attracts and one that invites and inspires confidence. A personality based upon a true love and sympathy for his fellowmen. His attitude of friendliness toward the injured employee must be absolutely sincere and not assumed. He must be able to put himself in the place of the injured employee and treat him as he, himself, would want to be treated. He must be a man of large, sympathetic understanding, capable of finding and reaching that point of contact which all persons possess, no matter how hard-boiled they appear, and which brings him into close accord with the employee.

You say that all physicians should possess these qualities in order to attain success. That is true, but the industrial physician should have them in the *n*th degree.

When employing a physician for industrial work, first consider his personality; second, his education; third, his technical ability. With two or more men whose education is equal, give the preference to the one possessing unusual personality over the ones possessing unusual technical ability. Technique, through practice and experience, may be acquired, but personality is something that must be born in you, or at least develop with you from infancy. It can rarely be acquired or changed in later life.

What I have said about the qualifications of the industrial physician applies equally as well to the industrial nurse, with the exception that her knowledge of the non-medical subjects need not be as thorough. Being a woman she is naturally more sympathetic than a man, which augments her innate gentleness.

Adequate training for the personnel of an industrial medical and nursing service consists in obtaining a medical or nursing education of the highest type; of developing an unusual amount of technical ability; of acquiring considerable knowledge of certain non-medical subjects that are peculiar to industry; and of possessing a personality that is the embodiment of sincere love for your fellowman.

To organize an adequate medical department in an industry, first carefully select the medical director who most possesses the qualifications I have enumerated, pay him a salary comparable with that of other men of like education and technical ability in the organization, and allow him really to direct the activities of the department without too much interference from the supervising executive.

TRANSPORTATION OF THE INJURED[1]

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IN discussing the subject of transportation of the injured, one finds that there are a number of allied subjects to be considered synchronously. The preparation of the patient for transport is important. The type of transportation itself must vary to suit the existing conditions. In discussing the subject of the transportation of injured in industrial accidents, we must first analyze the existing conditions and their economic relationship, and then we may ask the question, "Is there any room for new thought to improve the existing conditions or to introduce new methods to further aid the injured and to lessen the economic burden?"

All surgeons agree that nothing in the way of first aid is of more importance than the protection of the patient from infection and further injury while he is being transported to the hospital or other place of permanent treatment.

In this preparation the first essential is that the patient, whether he be transported ten blocks, ten miles, or one hundred miles, be so fixed that he will do himself no harm. This applies especially to patients with simple fractures for if immobilization is not brought about in such a case much harm may be done.

It is a cardinal rule that every broken limb should be lined up as nearly as possible in its normal axis and immobilized; this can almost always be done. There may not be at hand a box or splint, to be sure, but it requires small skill to extemporize something that will do the work. If the fracture is below the knee, a good safe temporary support can be made with an overcoat, blanket, bed quilt, or pillow on the outside of which a board, walking cane, or umbrella may be fastened by bandages, handkerchiefs, or strips of any material at hand. One of the very best and most comfortable temporary splints for fractures below the knee can be made with an ordinary pillow brought up around the sides of the limb and snugly bandaged in position either with or without an outside board splint.

Fractures above the knee can be immobilized with a folded blanket or quilt or bed bolster, over which a board or fence rail, from the waist line to below the foot, is fastened at the waist line, in the crotch, just above the knee and ankle with bandages, handkerchiefs, or strips of torn sheets or quilts. Such material can be secured under nearly all circumstances. The main thing to bear in mind is that under scarcely any conceivable circumstance is it justifiable to move such a patient until the fracture is comfortably immobilized. Otherwise a simple fracture will almost certainly become a complicated and possibly even a comminuted and a compounded fracture.

In railroad accidents, particularly, the fractures are not always simple, but are often compound in all grades of severity, so that the less one does the better, if the patient is to be put in the hands of a competent man in a few hours. One should straighten out the limb, coaptate the fractured bones the best he can without touching them, and cover the wound with the cleanest and best material at hand. If one cannot get gauze one can get freshly laundered soft linen or cotton goods, or even towels with which to protect the wound from further infection while the patient is being carried to the place for permanent treatment. It is extremely dangerous to attempt to clean compound fractures under such circumstances. Unquestionably, the safest method is to apply first aid as described, for the danger is nearly always immensely increased if an attempt is made to do anything more radical.

It is rarely, almost never, necessary to use a tourniquet in crushing injuries. It is infinitely better to let them bleed a little. The danger of hæmorrhage is not to be compared with that of applying a tourniquet and letting it remain in place for 2 to 10 hours. A surgical dressing should be applied snugly and nicely and the patient sent to the hospital or wherever he is going if he can get there in a few hours.

Small lacerations and punctured wounds are dressed and unfortunately frequently the patients are not sent to the hospital. It is a fashionable thing now for some "first aid" person simply to pour a little iodine into the wound or smear it on the wound and when that is done he believes that all indications and necessities have been amply met. Preferably all such patients should be sent to a dispensary or hospital and treated by a surgeon. If a limb has been fractured, it should be emphasized that first aid should consist in the application of a temporary splint and that the permanent dressing should not be applied until the patient is treated at the hospital. Except in the rarest instances and in the hands of an expert

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

who will have the case under continuous observation, it is extremely dangerous to put a plaster cast on a broken limb in the first few hours, especially if the cast is not cut.

In the initial treatment of a fractured limb for transportation, the Thomas splint has played a rôle with which all modern surgeons are quite familiar. Before the war many practitioners had no recollection of having seen the Thomas splint and comparatively few excluding those who had studied in Liverpool had seen one actually employed in the treatment of a fracture of the lower limb. The late Hugh Owen Thomas, of Liverpool, was a great benefactor of humanity. A treatise based on his work has recently been written by Sinclair.

As our knowledge of the Thomas splint is a by-product of the late war, we might well turn to our Medical Department, U. S. Army, for a further study of "Transportation of the Injured." Surgeons now in industries who served in training camps during the war may well apply their lessons in "Training Regulations," on the litter, the ambulance, the field litter carrier.

Surveys have shown that transportation of injured employees is provided by one or more of the following means: (a) private ambulance service situated near the plant; (b) taxicab, if the injury is not serious enough to justify the use of an ambulance; (c) company automobile, kept at the plant headquarters ready for emergency service; (d) employee's automobile which may be situated conveniently near the scene of the accident; and (e) street cars and busses. The last named are commonly used by ambulatory patients who return to the physicians for treatment and redressings.

Arrangements have not been made for an efficient, promptly-responding transportation service in many industries. Where various means of transport are depended upon and where none of the vehicles are under the control of the industry, delays are often encountered where promptness is most desired. This delay not only prevents prompt emergency treatment which is often vitally important to the welfare of the patient, but it also prolongs the pain and exposure which may extend the period of ultimate recovery.

It is a common practice in many industries to authorize mediocre treatment near the scene of accident, rather than develop safe and efficient transportation of the injured to a competent surgical service which includes adequate facilities for diagnosis and efficient treatment.

Railways have found it practicable and advisable from legal, surgical, and economic standpoints to transport injured cases, including fractures, to a central surgical service which may be made to provide efficient care.

Plant ambulance service may be provided in two ways: one owned and operated by the plant, or a so-called public ambulance. The value of the service depends on its availability, the time required to reach the injured, and its cost. We use plant owned and operated ambulances at some plants and public ambulances at others. The public ambulance charge is based upon a flat trip rate or call. At one of our plants where we operate our own ambulance and have an average of 27 calls per month, it costs $7.27 per call. This includes a yearly depreciation charge on the ambulance of about five hundred dollars per year. At another plant where we use a public ambulance the cost is $3.50 per call. The average time for the plant ambulances to reach the injured is 4 minutes and for the public ambulance it is 12 minutes.

Table 1 shows cost of plant owned and operated ambulance for period of 3 years at the South Chicago plant of the Illinois Steel Company.

TABLE I.—COST OF PLANT OWNED AMBULANCE

Number of calls in 1928.	
Illinois Steel Co	327
Other Companies	13
Cost	$2351.83
This includes $540 00 depreciation on ambulance.	
Number of calls in 1927.	
Illinois Steel Co	290
Other Companies	14
Cost	$2319.53
This includes $405 00 depreciation on ambulance.	
Number of calls in 1926.	
Illinois Steel Co	311
Other Companies	14
Cost	$2372.86
This includes $540 00 depreciation on ambulance.	
Average cost per call, 3 years	$7.27
At Gary, Indiana, a public ambulance service shows average cost per call	$3.50

While transportation of injured frequently is thought of as consisting of the handling of the severely injured patients, it may well be considered in cases of minor injuries. In a large plant which employs 5,000 to 15,000 men, a vehicle for bringing the slightly injured cases to a dispensary or hospital where a surgeon will care for them has many advantages. In such plants the buildings are generally scattered over a large area extending in either direction a mile or several miles, but frequently so-called first aid stations are common.

It seems that the transportation of patients with minor injuries—such as foreign bodies in the

eye, abrasions, lacerations, infections—to a plant dispensary with a surgeon in charge insures the patient better service and the company less loss of time. It also makes possible the securing of a complete record of the case which is often of great medico-legal value.

CONCLUSIONS

Patients with severe injuries should be transported to a dispensary or hospital where proper surgical treatment can be given. Only the minimum treatment should be given before the patient is transported. Transportation of minor injury cases to a dispensary or hospital and treatment by a surgeon are preferable to first aid treatments by "first aid" persons throughout the plant.

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DISCUSSION

Dr. W. E. Deeks, General Manager, Medical Department, United Fruit Company, New York: Transportation of the severely injured on the plantations of the United Fruit Company in the tropics presents somewhat different problems from those in the United States.

There are practically no transportation facilities other than those afforded by the railroads, except in the port towns where motor-car ambulances are available to convey the patients from the railroad terminals to the hospitals, in which all the severe traumatic cases are treated.

First aid treatment is given where the accident occurs, by dispensers, farm superintendents, overseers, timekeepers, or gang foremen, to all of whom first-aid appliances are made readily accessible. Railroad ambulance cars are immediately summoned to transport the injured to the hospital; or, in cases of great emergency, the nearest locomotive is commandeered to effect speedy transportation.

It is interesting to note that the native laboring population does not suffer the same degree of shock from severe injuries that prevails among the laboring population in this country; and, moreover, they appear to be more resistant to ordinary wound infections. On the other hand, owing to the widespread prevalence of anæmia as a result of blood and intestinal parasites, constitutional infections, and malnutrition, convalescence is often delayed.

First aid measures preparatory to transportation of the more serious traumatic cases to the hospitals do not differ materially from those utilized elsewhere.

GROUP MEDICAL SERVICE FOR SMALL INDUSTRIES[1]

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THE science of medicine has become very complex. Individual physicians no longer are expected to cover the whole field. Hence the increase in the number of specialists and the formation of groups. With this development has come industrial medicine, which though not a specialty is an adaptation of medical knowledge and practice to the needs of industry.

It may better be defined as the science, the theory, and the practice of medicine as applied to the prevention and alleviation of sickness, injury, and physical deterioration among industrial workers. It includes not only the practice of medicine in all of its branches—diagnosis, internal medicine, surgery, orthopedics, etc.—but preventive medicine as well. The physician in industry is a health officer and a practitioner.

With this conception it is apparent that no individual doctor can cover the whole field in industry any better than he can in general practice. Large and wealthy industrial establishments recognize this limitation and overcome it by providing for the services of specialists to supplement the normal functions of their medical departments. Small establishments, on the other hand, are unable to make such provision for the care of their employees because of the relatively great expense.

There are then these two reasons for the formation of groups to serve small industries: (1) industrial medicine is too broad a field for the individual practitioner, and (2) adequate service is too expensive for the average small industry. Therefore a scheme has been devised for the furnishing of complete medical service for small industries at a

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

nominal pro-rata cost and that scheme is, in a word, group practice.

Group practice in industry may be discussed from several standpoints: those of the employer, insurance carrier, employee, and physician. As a physician, I prefer to discuss it from the standpoint of the employee, for he is the beneficiary of the service, and its value is measured by the degree to which he is benefited. Any other measure is apt to be fallacious. Any other approach may be biased. As measured by this standard, the aims of medicine in industry are:

1. To assist the employee to obtain a kind of work he is physically, and possibly mentally, fitted to do. This requires physical examinations of new employees and a knowledge of job requirements.

2. To so guide him and surround him with safeguards that he may do his work without jeopardy to health and physical fitness. This requires re-examinations and inspections of working conditions.

3. To so treat him for injury and sickness arising out of his work that he will lose the least possible time and ability.

In other words, the purpose of medicine in industry is to assist the employee in maintaining, and possibly improving, his productivity and earning power, or wages. Although productivity and earning power are much the same, the employer is interested in the former, the employee in the latter. Products are what the employer wants, wages are the employee's demand.

So while we as physicians are primarily interested in the health and fitness of the workman, both he and his employer are probably more directly interested in profits and wages and are inclined to measure the value of the medical service by its effect upon those economic factors.

After all the distinction is trivial. We may approach industry from the standpoint of health, the employer and employee from the standpoint of profit and wages, but the result is the same. Better health and working conditions contribute to greater profits and higher wages. Nevertheless the group that will serve industry best must be in sympathy with the purpose of industry, though the matter of profit and wages need not dominate its actions. The group must be so constituted and organized that it can treat injuries with a minimum of lost time and impairment, offer such advice to both employer and employee as will tend to cut down losses of time and material, and must consider all medical problems from the effect they may have upon continuous and profitable employment.

Even so slight an affair as the time required for dressings is important. The group must be situated so as to offer the most expeditious service in this connection, centrally located so as to make it quickly available to the maximum number of employees it serves. If the number warrants in any one plant, dressing stations may be provided where dressing can be done at a given time daily.

Disabled patients must be returned to work at the earliest possible moment consistent with good treatment. Mutilated patients must be treated with their ultimate disposal in mind. Where can they best be placed upon their return and can special treatment fit them for some class of work other than that prior to accident?

Inspections must be made regularly in the factories served, followed by conferences with those responsible, and recommendations followed up.

Physical examinations and re-examinations must be made at the group clinic or in the factory, if provisions are adequate, always with the thought in mind that employment must not be hazardous to either the one examined or his fellow workmen. Nor must the fact be ignored that the information the doctor gains through the examination may be of value to the employee and properly belongs to him. Has he heart disease, or is he otherwise afflicted, the employer should know it.

The group should be prepared to make researches into occupational diseases or occupational conditions in relation to disease, and in times of epidemic to institute appropriate measures.

A group organized to carry on the foregoing program must be under the leadership of a physician who has a broad knowledge of industry and medicine. The minimum of activity must comprise general and orthopedic surgery, industrial hygiene, and plant service. On the staff should be enough physicians proficient in these branches to do the work, the number depending upon the number of industries. In the beginning it might be possible to combine general with orthopedic surgery and industrial hygiene with plant service. Assistance in the less active branches of roentgenology, dermatology, the specialties of the eye, ear, nose, and throat, dentistry, and the laboratory sciences can be obtained as needed from proper specialists allied to the group but not affiliated with it. It is presupposed that these are sufficiently acquainted with industry to correlate their work with that of the group. The development of its practice will determine the expansion of the group, just where specialists shall be absorbed by it and how rapidly the active staff shall be increased. Those are details that work themselves out as the practice of the group grows.

Hospital connections are imperative. All active members of the group should be on a hospital staff and active in their various departments, as well as active in the movement to better hospitals.

A word of warning should be offered. While a group of this character is essentially a professional organization it has an intimate contact with the world of business and commerce, a contact that must never be allowed to influence its ethical motives. It must never permit itself to become commercialized. No matter what its position in the business world might be, a professional group of this nature is essentially medical and it must conduct itself as ethical physicians are expected to behave. The first consideration must always be the welfare of the patient. There must be no solicitation of business connections, nor will that be necessary, for satisfactory service will cause a sufficiently rapid expansion. And in all other respects the group must conform with the code of ethics.

It does not occur to me that finance and fees can appropriately be discussed in this connection. The financial arrangements must be worked out by each group individually, and if the group conforms with the code of ethics, the question of fees is already answered.

In conclusion, group medical service for small industries is essentially group practice adapted to the needs of industry. It is group medicine and industrial medicine combined. Large factories provide their own service, so the group automatically finds itself serving small establishments. Its purpose is to safeguard the health and life of the industrial worker, and it does so through the following functions:

I. PLANT SERVICE

1. Visits to plant dispensaries or first aid rooms.
2. Sanitary inspections.
3. Health instruction.
4. Physical examinations, etc.

This plant service is entirely within the plants. If a factory is too small to justify a dispensary and individual attention, the service is rendered in the group clinic.

II. CLINIC SERVICE

1. Treatment of injuries and occupational diseases occurring in small plants which have no dispensaries.
2. Special examinations for the purpose of rendering opinions as to diagnosis, cause, and disability of cases in dispute.
3. Treatment of private patients. (A group may practice general and special medicine as it desires.)

III. HOSPITAL SERVICE

1. Surgical and orthopedic care of serious injuries, including reconstructive therapeutics.
2. Medical treatment of serious occupational diseases.
3. Care of private patients.
4. Hospital betterment. (All of the active staff should occupy positions in one or more general hospitals, and assist in their betterment.)

IV. CONSULTATION SERVICE

1. Surveys of plants to determine their medical and allied requirements.
2. Recommendations submitted in detail.
3. Assistance in organizing plant medical departments.
4. Supervision of plant medical department.

The organization may consist of the following:

1. The directing committee, or director. This committee or individual is responsible for the management of the affairs of the group.
2. The active staff. This may be composed of (1) a plant physician, (2) a general surgeon, (3) an orthopedic surgeon, and (4) an internist who may be also the industrial hygienist.
3. The auxiliary staff. This is composed of (1) professional assistants in clinic hospitals and plants, and (2) plant nurses, attendants and clerks.
4. Allied specialists. This comprises the following specialists whose services are supplied on request: (1) oculist, (2) roentgenologist, (3) dermatologist, (4) dentist, and (5) laboratory man, etc.
5. Clinic staff. This includes the assistants that are necessary for the service in the central clinic and carrying on the affairs of the group.

TRAUMATIC SURGERY IN THE CURRICULUM OF MEDICAL SCHOOLS[1]

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THE science of medicine and surgery has shown far greater progress during the past third of a century than at any similar period in its history. To those of us who have been fortunate enough to have observed at first hand the developments and attainments of the last 30 years there has been unfolded a panorama of scientific accomplishment replete with absorbing interest and stimulation for the student and pregnant with vast possibilities in the recognition, alleviation, and cure of human ailments.

Until the beginning of the present century surgery consisted largely in the application of mechanical principles to the solution of pathological problems without the knowledge and safeguards which have since been evolved, while the acquisition of surgical knowledge followed chiefly along empirical lines. Today the advance is chiefly along biochemical and biophysical routes as regards both diagnosis and treatment, physiological research affording the basis upon which such study is made. The intensive tilling of the surgical field has resulted in the growth of many surgical specialties: intensive study by the various specialty groups concentrated upon organs and systems of organs has thrown a flood of scientific light upon many problems whose explanation had remained heretofore elusive. The recent World War presented many questions which pressed for solution, furnishing the impetus and material for study which eventually resulted in the elaboration of already established specialties and in the development of new ones as well. As illustrative examples, neurologic surgery, thoracic surgery, orthopedic surgery, and oroplastic surgery have been fostered and developed enormously within the last decade under auspices furnished by the recent war.

To attempt to enumerate the advance made by these particular groups would necessitate a rewriting of the surgery of the ailments covered in their domain. While always included in the course of general surgery in the curricula of medical schools, as a result of their present day development and importance they have attained the dignity of departments or sub-departments in the surgical section.

Today the operation of the armies of industry, with their unprecedented development and ever increasing expansion, presents medical and surgical problems, which, while many of them are commonly found in the field of general surgery, frequently show characteristics peculiar to the industry in which they occur. In industrial centers the demand for the solution of these problems has resulted in the development of still another surgical specialty, and such specialists are concerned with the correlation of the various phases of industrial activities with day medical thought and care and as well with the prevention of accidents and the proper care and treatment of victims of accident. The economic aspect of the entire problem is seen at a glance upon referring to the report of the National Safety Council, from which some of the following are excerpts:

Non-fatal injuries in industry every year—3,250,000. Deaths yearly caused by industrial accidents—24,000. Deaths during 1928 caused by automobiles—27,500. While no nation-wide data on non-fatal motor vehicle injuries are available, representative states have reported about 35 non-fatal injuries of some seriousness for each fatality. On the basis of this conservative figure there were approximately 950,000 such injuries in 1928. Total fatalities from accidents in the United States during 1928—96,000, constituting approximately 6 per cent of all deaths. The death rate in males from accident is 112.3 per 100,000, being exceeded only by that of heart disease, which claims 187.2 per 100,000. Employees of industry incurring partial disability every year—115,000. Employees of industry incurring total permanent disability every year—1,150.

Estimated annual cost of industrial accidents—$1,000,000,000. Of the industrial accidents approximately 250,000 are infected cases, the infection entailing an extra annual compensation cost of $104,227,500 with approximately 450,000 weeks of disability.

The average increased cost of infected over non-infected cases is 416.91 per cent and the average increase in the disability period is $17^5/_6$ weeks.

Many agencies, as evidenced by today's program, are uniting their efforts to the end that the injured receive appropriate care and compensation. The American College of Surgeons is actively taking part through its sectional meetings at which some phases of traumatic surgery are discussed, through its program of hospital standardization in which special attention is

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

now being given to the equipment of hospitals with material for the most approved treatment of the injured, through its department of Clinical Research in collecting and analysing all available data concerned with the best methods of treatment in traumatic surgery, and through its Board on Traumatic Surgery, which, by means of surveys has acquired accurate data and knowledge upon which to formulate and direct intelligent study. It is apparent that the problems encountered by all of the agencies concerned are in large measure educational, this being particularly true of the medical profession in furnishing competent men for traumatic surgery. Real progress in the care of the injured can come only when the latter is administered by medical men who understand and are interested in the scientific principles underlying it.

Medical education has seen many changes in the last 30 years, conforming to the rapid expansion of medical knowledge while medical and surgical practice has been scientifically adopted to meet changing conditions and indications. The present status and number of industrial and other accidents, the tremendous human and economic loss and wastage they entail and the knowledge that there is decided room for improvement in their care and treatment justify and demand that the teaching of traumatic surgery receive adequate attention. The medical school curriculum is at present already filled to overflowing; the tendency to eliminate duplication, to reduce the number of hours of didactic teaching of facts readily accessible in textbook form and to give more time to bedside instruction gives promise of better balanced training with consequent better preparation for meeting the actual contingencies of practice. The principles of surgery must of necessity be acquired by the student as a basis upon which the superstructure of clinical study is to be added. It would seem practicable for the department of surgery so to correlate the teaching of the surgery of trauma that its particular needs may be emphasized without the undue addition of further hours to the curriculum.

Hæmorrhage and shock, burns, sepsis, asepsis and antisepsis, chest and abdominal injuries can be covered by general surgery; brain, spinal cord, and nerve injuries by neurologic surgery; fractures, reconstruction and rehabilitation, and physiotherapy by orthopedic surgery, without adding to the number of hours assigned them. The elucidation of underlying principles, the demonstration of newer and time-saving treatments, the application of procedures destined to accelerate restoration of function can be properly stressed in a way to sustain instructively the interest of the student in the surgery of trauma. The hospital emergency wards and the outpatient department, especially if the clincal department of the school has an accident service, can be made most interesting and instructive, preferably by a teacher who is engaged in some phase of industrial work. Such a teacher can also discuss the medicolegal aspects, compensation law and insurance features pertaining to such cases, since an understanding of these, combined with a correct ethical equipment, is essential to one who practices traumatic surgery. To impart this information to him, while yet a student, forestalls any but wilful deviations from professional standards when he subsequently enters a legal and business atmosphere where medical bills, schedule losses, and compensation awards are discussed constantly. The fifth or hospital year is now required by many schools and the majority of the graduates of those not requiring it take advantage of interneships when available. If a list of hospitals which maintain desirable and well organized emergency services were brought to the attention of the graduates it would permit such students as are interested in the surgery of trauma to apply for interneship therein.

At the present time a few schools are giving special instruction of limited extent under the heading of traumatic surgery, being as a rule conducted by some member of the general surgical or orthopedic staff interested in such work. One graduate school offers a short course under the same heading. With a wider appreciation of the importance and possibilities of traumatic surgery, increasing facilities for both undergraduate and graduate training are being provided. Surveys from time to time in the field of practice indicate the needs to be met by changes, alterations, or additions to the medical school curricula. Two years ago the result of a survey of a relatively large group of physicians was presented to the Association of American Medical Colleges showing their practice to be divided appoximately as follows: 50 per cent office patients, 35 per cent home patients, and 15 per cent hospital patients, indicating the character of instruction to be imparted properly to equip the graduate in medicine to fulfill the wants of the community he is to serve. In a paper read before the American College of Surgeons last year in the symposium on traumatic surgery, Dr. Irving Cutter gave the results of an inquiry directed to 1,000 graduates of Illinois medical schools, excluding those engaged strictly in the practice of medicine or a

medical specialty, showing that from 4 per cent to 20 per cent of their practice fell within the category of surgery of trauma. The report of the Committee on Fractures and as well a study of the litigation centering around and upon the results of the treatment of fractures afford convincing proof of the need for a more thorough teaching of their management and care if greater efficiency is to be attained. The report of the Board on Traumatic Surgery reveals the magnitude of the problem in its various ramifications, from which emerges quite clearly the indication for more efficient undergraduate and graduate courses in the surgery of trauma, the importance of which justifies the demand that it be fully met. The method by which this indication will be covered must needs be worked out by the surgical departments of the medical schools: in those in which the various phases of traumatic surgery are covered in more than one department, a close correlation of these courses with the definite purpose of giving efficient instruction should be sought. In others, where possible, all phases of traumatic surgery should be grouped in one course, furnishing the ideal means of giving the subject the emphasis its importance justifies.

SOME RECORDS CONCERNING TRAUMATISM AND MALARIA IN CENTRAL AMERICA[1]

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VISITORS to the Isthmus of Panama during the construction period of the Panama Canal frequently sought information concerning the leading causes of death and most of them were greatly surprised to learn that yellow fever, plague, and beriberi, were not among the leading causes of illness and death. It was less difficult to control these diseases than others, but the tragic part they played in the tropics before this period is still uppermost in the minds of many visitors.

I have arranged, in Table I, the various diseases commonly inquired about by visitors. These represent the causes of death determined at autopsy at Ancon, Canal Zone, from 1904 to 1919.

TABLE I.—CAUSES OF DEATH REVEALED BY AUTOPSY

Year	N. A.	Y. F.	B.	A.	T.	I.D.C.	P.	S. P.	S. B.	C.	F.
1904	6	..	..	..	..	..	..	..	..	..	..
1905	269	12	7	7	2	..	1	..	..	..	..
1906	509	1	5	4	..	..	..	..	..	..	..
1907	496	..	1	2	1	..	..	..	..	..	..
1908	361	..	1	2	3	..	..	..	..	..	..
1909	295	2	..	..	..	..	1	..	..	..	..
1910	451	2	..	..	..	..	..	..	..	..	..
1911	508	..	1	1	1	..	1	..	..	..	..
1912	425	1	..	..	1	4	..	..	..	..	..
1913	460	..	..	2	3	1	..	..	..	..	..
1914	375	..	1	..	4	2	..	..	..	..	..
1915	328	3	1	..	2	1	..	..	..	..	..
1916	323	..	2	..	..	3	..	1	..	..	..
1917	330	..	7	..	1	2	..	..	..	..	..
1918	253	..	..	2	..	3	..	..	..	..	..
1919	324	2	..	..	..	3	..	..	..	..	..
Totals	5,713	23	26	20	18	19	3	1	..	..	..

N A., Number of autopsies; Y. F., yellow fever; B., beriberi; A., ankylostomiasis; T., tetanus; I. D. C., infections diseases of children; P., plague; S. P., small pox; S. B., snake bite; C., cholera; F., filariasis.

For comparison with this record I have arranged Table II to show the leading causes of death in the order of their incidence.

Autopsies were performed on 70 to 90 per cent of the bodies that passed through the Board of Health Laboratory each month so that I believe these autopsy records furnish a fair index of the relative incidence of the causes of death in the Canal Zone. It is thus shown that the chief causes of death were due to pneumonia and tuberculosis. Malaria is the only disease, commonly listed as a tropical disease, that ranks

TABLE II.—CAUSES OF DEATH REVEALED BY AUTOPSY

Year	N. A.	P.	T.	Trau.	M. & H. F.	N.
1904	6	1	1	..	..	..
1905	269	60	9	3	27	8
1906	509	191	22	24	50	23
1907	496	156	35	40	27	27
1908	361	59	63	26	46	25
1909	295	55	37	32	26	31
1910	451	50	91	30	52	37
1911	508	83	102	38	41	36
1912	425	53	79	37	23	27
1913	460	47	89	34	21	26
1914	375	36	78	38	6	12
1915	328	28	56	20	14	12
1916	323	25	81	17	8	20
1917	330	24	51	21	5	23
1918	253	38	68	6	6	12
1919	324	22	55	15	3	14
Totals	5,713	928	917	381	355	333

N. A., number autopsies; P., pneumonia; T., tuberculosis; Trau., traumatism; M. and H. F., malaria and hæmoglobinuria; N., nephritis-chronic fever.

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

TABLE III.—FIELD SURVEYS FOR MALARIA

Region	1928	1927	1926
Tela (Honduras)	18.6	24.3	23.9
Truxillo (Honduras)	35.0	33.5	21.0
Chiriqui (Panama)	35.6	26.7	....
Costa Rica	19.0	34.9	29.5
Columbia	15.2	21.3	21.0
Guatemala	27.6	....	40.1
Almirante (Panama)	22.9	21.9	27.1
Preston (Cuba)	....	24.2	34.8
Banes (Cuba)	....	24.3	35.9

among the first five causes of death in this series of cases, yet the combined forms of external violence exceeded the death rate of malaria. It is not surprising that the construction period of the Panama Canal should reveal many deaths due to violence. The fall in the number of deaths due to traumatism has not been as great during the period of operation and maintenance as one might think, because the automobile, the airplane, and shop machinery are taking their toll.

Mortality rates do not necessarily reflect the incidence of diseases of the greatest economic importance as can be shown in the case of malaria.

It has been my duty in recent years to conduct rather extensive surveys for malaria in the labor camps of a large agricultural organization operating along the mainland and in certain islands of the Caribbean Sea. These surveys were made on all the men, women, and children found in the labor camps at the time of my visit. A microscopic examination of a blood film from each individual was done. The method used was the thick-drop-film stained and laked in an aqueous solution of Gimsa's stain. Table III shows the results of these surveys.

The island of Haiti shows about the same rate as the mainland, while Jamaica, in its worst foci, usually showed a rate of about 15 per cent. These races of high tolerance for the disease seldom seek treatment in a dispensary or hospital yet the "labor efficiency" is lowered to an important degree. Table IV shows the hæmoglobin estimations conducted. (Tallquist scale employed.)

This shows that a large proportion of the laborers scale from 60 to 70 per cent in their hæmoglobin estimations. Their ability to do manual labor in a consecutive daily manner is pretty well reflected by these same figures. Malaria, malnutrition, and intestinal parasites all participate in producing these results, but in my opinion malaria outranks the other factors.

TABLE IV.—HÆMOGLOBIN ESTIMATIONS ON 5,501 PEOPLE

Individuals with hæmoglobin index of	Per cent
30 per cent	0.23
40 per cent	0.67
50 per cent	2.9
60 per cent	18.3
70 per cent	41.3
80 per cent	29.1
90 per cent	7.4
100 per cent	0.09

It is difficult to impress, even on the local medical profession, how much malaria remains untreated in the field and how many individuals there are who can carry the infection with little or no acute symptoms. In order to get some figures on this subject, I checked the field surveys in three large coastal plain areas against the hospital cases under treatment on the days I collected blood films from the field. There were 126 labor camps in these three areas which had under treatment for malaria in the hospitals just 26 cases. My survey covered only 24 of these labor camps. There were 555 individuals found positive for the parasites of malaria in these 24 camps and 137 of them were as heavily parasitized as the 26 hospital cases on the day of their admission for treatment. The individual resistance is great in these races with a high tolerance to the disease, but malaria takes its toll to some extent in each infected individual. The course of traumatic surgery and obstetrics is frequently modified by an associated attack of malaria. The doctor must constantly keep in mind this disease as well as postoperative infection since many of our postoperative temperature rises are due to malaria. In spite of the tragic part played in our past history by epidemics of yellow fever and plague, I feel sure that malaria has been and is at present the great economic problem of the tropical coastal plains. The successful development of permanent industries in the coastal plains of our tropics must be paralleled with constant efforts in the control of malaria.

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INSPIRATION AND IDEALS OF THE BOARD ON TRAUMATIC SURGERY[1]

FRANKLIN H. MARTIN, M.D., CHICAGO
Director General, American College of Surgeons

I WAS very proud of the meeting this morning, beginning with the reading of the Minimum Standard for Traumatic Surgery. The address of Dr. Slobe showed him to be an administrator as well as a surgeon. Dr. Schram gave us the fundamentals in his talk. Dr. Wilson, the head of the marvelous medical department of the American Telephone and Telegraph Company, is a practical man in industrial medicine and surgery, as is Dr. Cheney, director of a most efficient medical department in a large industry, Armour and Company. It was interesting to hear the address of Dr. Selby on medical service in small industries; that of Dr. George G. Davis on transportation of the injured; and that of Dr. Herbert Clark, a scientist who has been trained in traumatic surgery with the discussion of his old chief, Dr. Deeks, on the problems of transportation of injured workers on the fruit plantations.

In the discussion by Dr. Abell of traumatic surgery in the curricula of medical schools, I expected to hear more emphasis placed upon the importance of administrative and organizing ability as essential qualifications for successful industrial surgeons. In time medical schools will segregate their classes and determine not only those who have administrative minds but those who have medical and surgical minds in order to qualify them as industrial surgeons.

In 1920 a man with vision started this movement for the better care of the injured. As a railroad surgeon and chairman of the Medical and Surgical Section of the American Railway Association, he addressed that society saying that the best service was not always being given to patients because they were not always sent to proper hospitals. He explained the standardization of hospitals by the American College of Surgeons and the requirements relative to the care of patients. The enthusiastic response of the railway surgeons led to the drafting of a resolution which recommended to the American Railway Association "That whenever possible only hospitals rated as Class 'A' by the American College of Surgeons be recognized, and when railroads have their own hospitals, that such institutions not already so classified be brought to such standard." A committee of surgeons told the story of hospital standardization, presented the resolution, and asked that it be adopted, whereupon the American Railway Association, on November 16, 1921, approved the action of its surgeons, and adopted the resolution as presented. This meant that instructions were sent to 14,000 surgeons of whom less than 4,000 were members of the American College of Surgeons. What was the result? It was found that the average days' stay per patient was reduced from 14.6 to 11.9 days, or a saving of 2.7 days. The beginning of this movement is due to the efforts of our old friend, Dr. Daniel Z. Dunott, of Baltimore, whose untimely death we so much regret.

After a time when standardization of hospitals became better known and Dr. Dunott became the head of the medical department of one of the big indemnity companies, he came to us one day and said: "Why don't you do for industrial surgery what you did for hospitals?" If there is anything to be done that will improve surgery and hospitals and the treatment of cases, we are willing to do it.

Three years ago a Board on Traumatic Surgery was organized. This Board was appointed after 2 years' investigation of the subject, and so we are here today to discuss matters pertaining to industrial surgery. Some of the leaders in this specialty have talked to you this morning in an effort to convey the fact that if you are going to do industrial surgery you must have something besides a knowledge of surgery. The head of an industrial surgical and medical organization not only must have the education of a physician but also must have administrative and organizing ability. He must have also a high moral and ethical standing—be able to meet the crook and turn him down.

One reason we are discussing this subject now is that for many years our state credentials committees rejected applicants for Fellowship in the College because such applicants were contract surgeons working on a salary. There might have been good reason for that action at one time and there may be good reason for it now, but at least we investigate the application. If the contract surgeon divides fees with indemnity adjusters or with poorly equipped hospitals or makes other unfavorable financial arrangements, he is the kind that should not be accepted. Since this Board has been organized, we have discriminated; the salaried contract surgeon who is on the square,

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

who is a competent surgeon, and who is an administrator in a great industrial organization should be accepted for Fellowship in the College.

For three years, industrial and labor organizations and indemnity companies have supported this movement for the better care of the injured. The program is accepted by those who are vitally interested in the man in industry. It is accepted by the profession and by this great organization which is taking, we hope, the leadership in this work.

Advisory committees have been appointed in every state to help us select the type of men who know medicine and surgery and who are in position to administer and organize medical departments. There are many names on our list at the present time. Of the thirty thousand men who practice surgery in the United States a large percentage of them, at least 50 per cent, will in time help to care for the injured and sick employees of industry.

SUMMARY OF SURVEYS MADE BY THE BOARD ON TRAUMATIC SURGERY[1]

E. W. WILLIAMSON, M.D., CHICAGO

THE initial report of the Board on Traumatic Surgery to the Board of Regents of the American College of Surgeons was presented in such a form as to leave no doubt that there exists a distinct economic as well as a scientific problem in the care of the injured in which surgeons could be of great assistance in improving conditions in this special field of surgery.

In order to secure direct information relative to prevailing methods for the care of accidents in industry and the results of treatment, surveys have been conducted in large industrial centers of the United States.

To one familiar with the subject, the summaries of these studies may seem elementary, although the reports have a definite purpose. The information contained therein is fundamental and worthy of exposition in order to supply basic material for a constructive program in traumatic surgery.

ORGANIZATION AND ADMINISTRATION

Special attention has been given to a study of organization and administration of the medical service in industrial plants, insurance company medical departments, and hospitals.

There are many large companies in which the medical service is centralized and successfully operated under the supervision of a chief medical officer with full administrative responsibility. This plan of organization is recommended.

In contrast to this plan, there are many industries which disregard the importance of medical supervision by placing the medical service subservient to and under the direction of another department of the company directed by non-medical officials.

This plan is fundamentally unsound and should be condemned as it delays the development of a complete medical service.

Large industries often assign the administration of the compensation and medical department to the claim division. The legal aspect predominates and the accident case is regarded essentially as a claim imposed by compensation law, while the medical service extends no farther than the employment of a physician to treat the injury.

We emphasize the importance of the closest cooperation between the medical, claim, personnel, safety, and employment departments, but are unable to justify the administration of the medical service by a department in which the decision of medical questions and the appointment of surgeons are entrusted entirely to the judgment of non-medical officials.

Plants which do not have medical departments are practically without medical supervision. They depend upon the use of a first aid service and a neighborhood physician to treat accidents. The insurance company is often entirely relied upon to provide treatment and arrange settlement of cases. Organization and scope of service are thereby reduced to the simplest terms—sufficient only to meet the requirements of the law. The result of minimum equipment and service is maximum absenteeism due to illness and injury.

In the selection of a physician, professional qualifications are not always regarded as an important major requirement. Too often the physician is selected on the basis of (1) location in the vicinity of the industry, (2) agreement on fees for professional service, (3) personal acquaintance or relationship between the physician and the com-

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

pany official, (4) recommendation of the insurance company carrying the risk, and (5) local reputation as an industrial surgeon.

Physicians are employed full time only in large industries which maintain an extensive medical and surgical service. The most common arrangement is the employment of a physician on call, to whose office most accident cases are sent for treatment. These physicians seldom have an official connection with the industry and in no way are allowed the responsibility for directing the accident and health activities of the plant. In reality the doctor is often engaged on a temporary status and may be relieved of his position with the company at any time, particularly so if he is employed on a fee basis or if there is a change in indemnity carriers. Thus, under these conditions the relationship between the physician and the industry is not close enough for the most efficient service.

The responsibility for the health and accident service of an industry should be fixed upon the physician who may then be held responsible for end-results.

To raise the standard of industrial medicine and surgery there must be an improvement in the environment of the physician, particularly the physician who maintains an office in the district, in order that the field may be amply supplied with well qualified practitioners. This means (1) a solution of the economic problems with which he now contends, (2) the administration of medical matters by medically trained persons, (3) a closer working relationship between physician and industry.

ADJUNCT MEDICAL SERVICES IN INDUSTRY

Adjunct medical services in industry are supplied by hospitals, medical departments of insurance companies, and private offices of physicians which admit a vast number of industrial accident cases for treatment.

Instead of "Industrial Hospitals" designed, equipped, and organized especially to serve groups of plants in the same localities, practically all the general hospitals admit industrial accident cases for treatment. This wide distribution, rather than centralization of cases accounts for the wide diversity in standards of service and variation in charges made therefor.

Some hospitals which operate active departments in traumatic surgery are well equipped and provide adequate service; many others are in need of better facilities and organization in order that they may do their part in returning the great toll of injured to industry in the shortest possible time and with the least amount of permanent disability. Because of the important position occupied by hospitals in the treatment of the more severe injuries, and on account of the wide variation in service, there is an urgent need for raising the standards of these departments. Special attention should be directed to organization, personnel, equipment, and diagnostic, and therapeutic facilities. The approval of a complete unit of service clearly defined would serve as a guarantee to industry that the department is giving the best treatment that modern medicine affords.

Indemnity companies have become active agencies in providing medical service to industry by the establishment of their own medical departments. There is a trend toward an increase in the number of insurance clinics and in the number of patients treated therein.

The indemnity companies' reasons for operating medical departments are:

1. *Economy.* Installation of a centralized medical department is said to lower medical expense and compensation by reducing temporary total disability, thus allowing the employee to return to work with a minimal loss of time.

2. *Better control of cases.* Patients may be concentrated to a large extent in the insurance medical department under the immediate direction of the company's physician who is familiar with compensation practice and in a position to reduce the number of contested cases and delayed settlements.

3. *Settlement of claims.* The settlement of claims is made more readily through frequent contacts with the claimant in the insurance medical department.

4. *Business assets.* The medical department is an excellent business asset as it invariably creates a favorable impression upon the prospective buyer of insurance and upon the policy holder.

Physicians in industry are engaged principally in the treatment of injured employees. Even today numerous industries have not extended the work of the physician beyond the requirements of the Compensation Law. The delayed development of a complete health and accident service is due largely to the failure of the medical profession to acquire active leadership in the promotion of this important specialty. Physicians have failed to determine a complete unit of service and have it accepted by the employer as an essential part of his business.

CONCLUSION

That there is yet much to be done is shown by the fact that illness causes from five to twenty-five times more loss of time than accidents and that only a comparatively few plants to date have gone

further than to care for accidents. Reliable authorities[1] state that "industrial hazards cut ten per cent from the span of life and that the remedy is neither impractical nor out of reach." The remedy is the employment of specially trained medical service that would provide health education, correction of physical defects, proper placement of employees in jobs agreeable to their physical capacities, a more rigid control of the predisposing factors of occupational diseases, and the periodical examination of employees.

Let us carry on an active program not only for raising the standard for the care of the injured but also for giving special attention to a health inventorium in industry as well as in hospitals.

[1] Louis I. Dublin, Metropolitan Life Insurance Company.

VALUE OF MEDICAL DEPARTMENT TO INDUSTRY AND ITS NEEDS[1]

R. V. MASSEY, PHILADELPHIA
Vice-President, Pennsylvania Railroad Company

IT is not only a pleasure to appear before this organization, but an honor which anyone might well appreciate. The Pennsylvania Railroad has been engaged in promoting the health and well-being of its employees for a long time. The same is true of other large American railroad systems.

Much of our work has been humanitarian in character, intended to foster the sense of loyalty and increase the attractiveness of the occupation by providing safeguards against misfortune.

The first important agency for carrying on work of this kind was the establishment of our Voluntary Relief Department in 1886. The primary purpose of the relief department is to provide a means whereby our employees can, by payment of small sums monthly, secure for themselves and their families cash benefits payable in the event of death, sickness, or accident. The railroad bears the entire cost of operating the department, so that the contributions made by the employees are available, without any deductions whatever, for the sole purpose of paying benefits and allowances. The protection afforded our employees in this way was made available at a time when no other insurance agencies were in existence to provide it at reasonable rates.

At the end of 1928 the relief department showed a membership of nearly 185,000 and it had distributed over $4,800,000 in benefits during the year. Since its establishment in 1886, over $101,000,000 has been paid in benefits and allowances, while the railroad has contributed over $18,000,000 toward carrying on the work of the department.

These provisions for sick and injured employees and designated beneficiaries in the event of their death are actuated by truly humane and benevolent purposes, and in their continuous development are bringing about a feeling of mutual regard and respect between capital and labor.

A feature of our relief department work and one which has assumed great importance is the medical and surgical staff maintained for the benefit of our employees.

This department has under its supervision and scattered through all parts of the railroad system 118 physicians and surgeons, who devote their entire time to employees requiring treatment. These men constantly strive to keep the minds and bodies of our employees in the best possible condition. We seek, through rigid physical and mental examinations, to prevent men liable to sudden incapacities from entering our service, and thus to avert possible trouble; to keep an accurate check, through periodical examinations, of the men actively engaged in the operation of trains; and to see, by requiring compliance with proper standards, that the eyes and ears of railroad men are always on the alert.

Our full time physicians are stationed at important centers along the railroad, and connected with each office is a dispensary where employees may secure free treatment for both accident and sickness. Emergency supplies are available for immediate use at strategic points, and fully equipped first aid cabinets have been placed in many locations. At other points, such as yards, shops, and transfers, a complete first aid room is in operation.

First aid boxes are carried in baggage cars and cabin cars and are available at other points where any number of men are employed. Employees in train service, in shops, in yards, and in our maintenance of way department, including foremen, receive first aid instructions to enable them

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to act promptly and properly in cases of emergency.

These demonstrations are of a practical nature, the employees being trained to apply splints, place a person on a stretcher, apply bandages, stop hæmorrhage, and treat shock. They also are trained in the art of aiding respiration by artificial methods. These instructions are given by the physicians of our medical department.

Uncompromising cleanliness in Pennsylvania dining cars is obtained through inspections by our physicians of all food and kitchens, and in addition all dining car employees are subjected to a thorough physical examination each month.

In addition to our regular medical force, we retain the services of a staff of outstanding specialists in practically every disease and every branch of surgery. We also retain eye specialists to whom any employee is free to go for examination, treatment, surgical work, or prescription for glasses.

Another important work in connection with the operation of the relief department is the rehabilitation service. Every report of disability occurring among our employees is carefully checked up and, if necessary, the patient is placed in the charge of a specialist for his opinion and, if deemed advisable, for treatment.

What we try to do, in every case in which there is any way to effect it, is to cure the man as soon as possible and get him back to his old position and full earning power. If it is not possible to return him to his former occupation, it is the function of the rehabilitation bureau to find a suitable position for the man, so that he can again be self supporting.

The World War drew the attention of all to the necessity of reclaiming disabled veterans for suitable occupations upon return to civilian life. Figures compiled at that time indicated that casualties were greater in industry than in war. It was not until after the war period that any particular attention was directed toward the solution of this important problem.

We believe that the Pennsylvania Railroad was a pioneer in this great humanitarian work, and the service rendered by this branch of our service in placing our disabled workers in gainful occupations has done much toward relieving distressing conditions.

In addition to the physicians under the supervision of the relief department, there are approximately 700 company surgeons, stationed in all important towns on the railroad system. These physicians give attention to accident cases when called upon in an emergency.

This complete medical and surgical force, which necessarily involves a large expenditure, clearly indicates our desire to render efficient medical service to our employees.

It is quite evident to our management that the physician has found a permanent place in our business life. Communities are more and more coming to realize the value of improved sanitary standards and health conditions and are spending large amounts to secure them. Our physicians can and do carry these ideas into the minds of our employees, who themselves frequently form a large part of the population of the towns located along our lines, so that our workers willingly assist in the maintenance of sanitary homes, streets, and public places, and in the safeguarding against the inevitable hazards.

We believe that the medical work which we are maintaining in our industry has demonstrated its economic value, the full extent of which cannot, of course, be measured merely by dollars and cents. We feel that our medical department is rendering an essential service in helping to build up a high physical standard among our workers.

As business grows more complex and intense, the physician in industry will necessarily become a more valuable assistant in the management of our railroad.

Our railroads have, especially since federal control, made marked advances in service to the public, and these results in a large measure have been accomplished by a realization on the part of the railroads that one of the most important factors in the conduct of business is the human relationship. We, therefore, feel that the result which has been obtained is due largely to the care that has been given our employees, when disabled through sickness or accident, by the men in the medical service of the railroad who are members of your great profession.

VALUE OF MEDICAL DEPARTMENT TO INDUSTRY AND ITS NEEDS[1]

R. V. RICKCORD, NEW YORK
Director of Personnel and Statistics, Brooklyn Edison Company

IT is thought, in connection with this paper on industrial medical work, that the best results will develop if the statements contained in it are largely confined to, and based on, definite practical experiences. For this reason the following statements are based on the work of the Brooklyn Edison Company's medical bureau, which is now in its eighth year of operation, and they are intended to suggest the value of these activities to industry.

The medical activities of this company may be divided into three groups, namely: the examination of new employees, the maintenance of the health of existing employees, and the care of accident cases.

With regard to the first mentioned activity, the examination of applicants, this might now be said to be an almost absolute necessity to industrial concerns. In the first place it seems to be an exceedingly unwise procedure to allow an employee to do work for which he is physically unfitted.

It is of course the medical bureau's responsibility to make the decision as to whether the employee is suitable for a particular vacancy or not. In modern organizations the physician is or should be provided with an analysis of the various positions. This job analysis defines the work and the conditions under which it is performed and provides the basis on which the physician may make this judgment.

One of the important uses of the physical examination of applicants is the opportunity it gives for adjusting them to the right work. Most concerns can and do employ individuals with minor defects, but they keep in close touch with them to see that the condition is not exaggerated. The procedure that no concern can afford to adopt is the wholesale employment of decidedly defective individuals. This undesirable condition is prevented by the physical examination of applicants.

Large industries disburse much money in the way of sick pay, insurance, and death benefits. In the Brooklyn Edison Company these payments amount to approximately a quarter of a million dollars annually. If permitted, they might easily reach twice that amount, but instead they are limited through the physical examinations given to applicants for employment.

Looking at the question of medical examinations from another standpoint, the company is entitled to full value for the money it pays in wages. This cannot be accomplished if the employee is physically defective at the time he enters the organization.

The present speaker recently witnessed the examination of a group of laborers. About 50 per cent were rejected for causes which would seriously impair their activity on the job, and which would perhaps be a fruitful source of accidents. These rejected applicants could not possibly have produced more than one-half the quantity of work which might be expected from the others.

As regards the second group of activities, namely, the maintenance of the health of the employee, perhaps the largest part of the physician's time under this head is given to voluntary requests on the part of the employees for advice and minor treatments. These treatments are almost entirely of a type that the employee would neglect if it were not made convenient for him to receive them.

The advantage to the company of these treatments is that in numerous minor conditions, for which ordinarily time off would be taken, employees are enabled to remain at work and to continue to devote their time to the job almost without interruption. Those employees who would ordinarily slow down and become inefficient, because of a temporarily painful condition, are often relieved by treatment and quickly return to their usual effectiveness.

In an efficient organization the supervisory employees work very closely with the medical bureau and are usually very glad to refer to it all questions concerning the physical condition of employees. It is the medical bureau which should decide whether the employee shall remain on the job or go home. No other group of individuals in the company can properly make a decision of this nature.

Increasing evidence indicates that, where these opportunities for medical advice exist, the employee takes a great deal more treatment than would otherwise be the case both in the company's medical bureau and also at the hands of the family physician. This is of course the objective of most companies, to keep the employee in the best of health. The organization is usually willing to permit its own physicians to do preliminary work along this line but also feels that much

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

of it must be provided by the employee's own family physician.

If the medical bureau succeeds in stimulating the employee to look after his health, it has accomplished its main purpose. Thousands of patients a year present themselves in a medical bureau like that of the Brooklyn Edison Company in which the physicians insist that the employee take treatment from his family physician, treatment which would otherwise be neglected by the employee.

Another important factor in maintaining the employee's health is the supervision on the part of the physicians of the nurses' visits to sick employees and the examination of these employees on return from sickness. In connection with this work, the company's best interests are represented by the exercise of a fine discriminating judgment on the part of the physicians.

Employees must not be permitted to sham illness, nor to extend absences after a cure has been effected. Also employees returning after an illness should not be permitted to commence work if, in the opinion of the physician, a further absence seems to be necessary. The supervision of these conditions by a physician, and the exercise of justice and firmness by him in dealing with them, is of much importance to the company. Unless this kind of judgment is exercised, the sick payroll is likely to increase enormously.

In connection with the treatment of sick employees by the family physician, the company's medical bureau can be of great assistance. Since it is in contact with the employee all the time, it usually has an excellent medical history it can place at the physician's disposal. In addition it can furnish X-rays, biological analysis, and reports of various kinds, which from time to time it may have been instrumental in securing.

Since it pays the employee during sickness, it can bring to bear the moral support on the employee in the matter of treatment which the family physician and the company's physicians deem wise in the case. In general, where these facilities exist, very close co-operation results, to the great advantage of all the individuals concerned. In practice the employee very much appreciates the service he has received and the activities become a means of enhancing his good will toward his company.

If the employee is satisfied he will ask the company's physicians about procedures for his family, what hospital to use, what physicians can do a particular piece of work, where he can buy certain surgical apparatus. It might be interesting to note that in the medical bureau of the Brooklyn Edison Company, where it is thought that fine relationships have been established, the total number of medical contacts between the physicians and employees have reached a total of seventy-five thousand a year, the number of employees being approximately ten thousand.

The third main group of activities consists of accident treatments and related work. In many concerns accident cases absorb much money, by the absence of employees and disability compensation. Therefore, any improvement that can be introduced both in the way of prevention and in the treatment of accidents is of great benefit to industry.

It is a good start to insist that every accident of every kind, no matter how small, be reported to the medical bureau. Also it is not too much to ask that every employee so reported receive treatment from the physicians of the company. Only by such rules can the supervising physicians be held responsible for preventing the development of serious conditions.

If there were any question as to the value of systematic industrial medical activities, the work conducted in connection with accidents alone would remove such a question. When an accident occurs it is a great reassurance to feel that the condition of the employee was known before the accident took place and that only as much compensation can be claimed by him as is justified by his injury.

Experience has shown that sometimes a medical bureau will pay its expenses by what it can save a concern in its accident activities alone. Until recently it was almost a rule for an injured employee partially to lose the function of an injured part. In a concern which has an effective medical bureau, with facilities for giving massage and similar treatments, loss of function has practically disappeared, and with its disappearance many thousands of dollars a year have been saved.

Accident cases frequently involve the attendance of a physician at court. Attendance at court is an expensive undertaking, both for the physician in regular practice and for the company which employs him occasionally for this work. Besides as a rule he will not have had personal contact with the accident involved or the employee concerned.

It is very advantageous to have a physician regularly employed who can do this work. If medical work is properly organized, with sufficiently skilled medical talent, the company's physicians can usually arrange their time and their services so that court work can be readily undertaken. In the Brooklyn Edison Company, we

believe there has been a great improvement in this service since this method has been followed.

The foregoing statements do not take into account the many activities of the physicians which are more or less special to the company which employs them. The matter of resuscitation work is one of these specialties. As a rule the physician in regular practice does not know much about the latest developments in this field.

The physicians of the Brooklyn Edison Company, in co-operation with several of the leading medical colleges, have developed a highly organized technique. Since they cannot be on the spot at every drowning or gas asphyxiation case they have made arrangements whereby all employees practice resuscitation four times a year. In addition, the physicians never lose an opportunity to demonstrate this technique when requested to do so before local medical associations, fire and police departments, life guards, and similar groups.

If the work of instructing employees is well done, it is found that they are only too willing to learn the physician's instructions and to put them into practice. No hours seem to be too long for them or sacrifices too great when called upon for assistance. Recently some employees were called upon to help in a gas asphyxiation case. By taking turns, they worked continuously for thirty hours. In connection with this case the following thoughts were expressed by the director of the Methodist Episcopal Hospital to Mr. M. S. Sloan, president of the Brooklyn Edison Company.

My dear Mr. Sloan:

I wish to express our appreciation of the splendid service rendered by your company in the case of Mrs. Schindler and her two children who were brought into our Hospital by our ambulance unconscious from gas poisoning. We were all much impressed by the efficiency of the organization in their efforts to help these patients.

I would like, also, to commend the men who were active in this good work; they were very courteous, considerate and diligent. One of them gave his blood for the transfusion which was undertaken in behalf of the little boy. We have a Blood Transfusion Fund here but he would not accept any compensation.

If the medical work of the Brooklyn Edison Company is efficient, it is based on the thought that was expressed by Mr. Sloan to the effect that "we must try to do our work at least a little better than any one else is doing it." And in the effective carrying out of these instructions, the services of the supervising physician, Dr. J. J. Wittmer, have contributed most.

It is inspiring to note the grip that the physicians have on the employees' medical welfare and how splendidly informed they are at all times of the physical characteristics of practically all employees.

One is led to suggest that properly organized medical bureaus in industry have an almost unrivalled opportunity to develop and maintain the health and productiveness, and therefore happiness, of large groups of individuals in a manner which is almost impossible in any other connection.

WHAT BUSINESS EXPECTS OF THE MEDICAL PROFESSION[1]

JAMES S. KEMPER, CHICAGO
President, Lumbermens Mutual Casualty Company

IN an article which recently appeared in the *New York State Journal of Medicine*, Dr. Winslow, of New Haven, called attention to a famous Chinese proverb, which goes something as follows: "The high grade doctor serves the nation; the middle grade doctor serves the individual, and the low grade doctor merely treats physical ailments. The doctor who not only considers his patient as a whole individual rather than a mere mass of symptoms but also considers the entire life of the individual in relation to his occupation and his home and the society in which he lives, is indeed the one who serves the nation and who serves mankind." In the reference I shall make to the medical profession I shall have in mind, and I hope you will have in mind, that the great majority of its members classify under the Chinese proverb as high grade doctors.

Except as applied to life insurance the interest of insurance companies in co-operative work with the medical profession came with the enactment of workmen's compensation legislation in the year 1911 and the years immediately succeeding. True, the casualty companies had medical departments in connection with their health and accident business but by and large these departments were maintained not so much for the benefit of the injured person as for the protection of the companies against possible fraudulent claims. I regret to say, too, that in some cases medical departments were used more largely to defeat claims than to justify them.

During the early days of compensation legislation, there was a disposition on the part of some insurance companies to view the payment of compensation claims in much the same manner as they had previously viewed the payment of indemnities under health and accident contracts and employers' liability policies. With the advent of compensation, however, came a largely increased interest on the part of the employer in the handling of payments to his injured men. That, combined with the forward looking, humanitarian viewpoint of many of the insurance companies, brought about in a comparatively few years a complete revolution in the insurance attitude toward the whole question of the care and compensation of injured men.

I well recall that in the early days of our own company, we were taken to task by an insurance executive of the old school who, in all sincerity, predicted for us a disastrous future if we continued our policy of immediate recognition of injuries to workmen and proper compensation to, and rehabilitation of, injured men as a just charge against the cost of operation of any business.

I recall, too, that our attitude toward the medical profession also was criticized and I think in good faith. It seemed to us that if the spirit of the compensation act was to be carried out properly it could be done only through the closest possible co-operation and the utmost effort toward mutual understanding between the employer and his insurance carrier, the employee, and the doctor. So we took the doctors into our confidence and gave them practically *carte blanche* all along the line. It was rather unusual for an insurance company to say to a doctor that it would leave its interests entirely in his hands and yet that is exactly what we did and it is with no little pleasure and gratification that I am able to say to you today that our confidence was not misplaced.

Business expects much of the medical profession, and properly so. Admittedly, there is a great deal that could be criticized in the way of inadequate and unskilled attention, acceptance of so-called split fees, professional jealousies, and unnecessary and unjustifiable red tape, particularly in hospital procedure. I cannot refrain from taking this opportunity of mentioning to you one particular rule in vogue in some hospitals which I, for one, have never had satisfactorily explained. I refer to the rule that makes it impossible for a nurse to communicate directly with the doctor in charge of the case and instead requires that all her communications with the doctor be made through the interne.

I hope and believe that evidences of what may be unnecessary red tape in the medical profession are exceptions that prove the general rule of your sound judgment and common sense.

If the modern business man were to make one recommendation to the modern doctor it would be to take the mystery out of medicine. American business long ago discarded its swaddling clothes in the matter of business policy. Today, it not only collaborates and co-operates with competitors in matters of mutual interest but it encourages employee ownership, customer ownership, and public ownership. And it takes the customer

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14–18, 1929.

and public into its confidence. Open, frank, straightforward, fair dealing has come to be the rule and not the exception in modern business.

And so we of business suggest to you of medicine that you take the customer and the public into your confidence. We commend the steps you have already taken to tear down the walls of secrecy that too long have surrounded your fine profession. We feel certain that if you do succeed in taking the mystery out of medicine it will redound to the credit of the profession and add tremendously to its accomplishments and to your own satisfaction and profit.

Reverting now to the insurance aspect of the situation. If the compensation insurance carrier as representative of the employer is adequately to fulfill its mission, it must have from you the best and most conscientious effort you can give. It is reassuring in this connection to observe the increasingly prominent position the industrial surgeon holds in the profession and the increasing respect in which he is held by insurance. There is scarcely a company of any consequence today but has a medical department made up of the best talent available. And it is encouraging, too, to observe that the average staff surgeon is open minded with respect to new developments in the handling of cases and is invariably willing to benefit by the judgment of a fellow surgeon outside.

Insurance companies now view the selection of a medical staff as a matter of first importance. This is not only proper from your standpoint but necessary from ours. It is much more difficult in the smaller communities to get competent surgery for industrial accidents than for such work as appendicitis, for example. When you realize that a very large proportion of our losses come from permanent partial disabilities left by fractures you will appreciate how important it is that we should have not only good surgeons but those skilled in traumatic surgery.

Not a day goes by in our company that we do not want the name of someone in Michigan, or Iowa, or Minnesota, or some farther away state to do important surgical work. It seems to me that the American College can do the profession and business a distinct service by making available to those of us who represent the employer information as to the men best equipped to do traumatic work. I understand that something is already being done by the profession itself to provide more intensive graduate courses in traumatic surgery. I cannot conceive of a better method to equip this great specialty in surgery as it deserves to be equipped. The path which has led to specializing in industrial surgery has been too haphazard in the past and if a definite channel could be established similar to that provided for those wishing to specialize in eye, ear, or nose work, it would help both the profession and the industry it serves.

There is one great field of industrial surgery and insurance medical service still in its infancy. I refer to the rehabilitation of injured men, the restoring of victims of industry to a status of self respect, again making them able to support themselves. In my judgment there is scarcely a task facing you, the medical profession, and us in business today which has a better right to demand the best of effort and brains that we can lend. The work being done by federal and state agencies should be supplemented by organized help from private agencies. Every contribution toward making rehabilitation more effective is a great social service and I am sure you will agree with me that the medical profession and business should become increasingly active in this field.

In the history of the world, this of all times is the economic era. In this era the world looks to business for the maintenance and enhancement of that standard of living which makes the home life of the artisan of today more expansive and comfortable than that of the king of yesterday. American business has measured up to this opportunity. American standards of living, conveniently measured in the number of automobiles or bath tubs, for example, surpass anything heretofore known.

To grasp fully the opportunities of the future, business must first of all be kept fit physically. We look to you of the medical profession to do this job for us and to do it even better in the future than you have in the past. We ask you to help us fit the applicant to the work suited to him. The efficiency of men and women in business should be improved by taking adequate care of those whom the workers leave at home in the morning and return to in the evening. We should extend every effort to see to it that the man who is injured is made comfortable and is returned to work without depreciation in his capacity to do work.

We expect in this field that you will indeed go on from wonder to wonder so that the traumatic surgical marvel in repair and rehabilitation of today will be the commonplace of tomorrow. I am sure you would not want us to set for you an attainment any less lofty. Particularly we want you to place an emphasis upon human values that will prevent the possibility, however slight that possibility may be, that dollars and cents will ever, even unintentionally or thoughtlessly, be allowed for one moment to weigh in the balance

against sacred human life. The true measure lies in the preservation of invaluable personalities, in the retention of loyal and experienced workmen, and in the satisfaction that comes from defeating death, disfigurement, and disaster.

Business expects to be held to the highest mark of idealism in the care of its injured workmen. By the same token business expects that traumatic surgery will co-operate in eliminating those who would prostitute the profession, who would bear false witness or condone perjury, or who would contribute in any way to an improper reward to an individual, which must always be to the disadvantage of the fair, honest, and honorable.

Yours is a great heritage. Through all the years men and women in every rank of life, in society and in business have entrusted their all to your care. It should be inspiring to you, as it is to the world at large, that you have measured up to this great trust, to this great responsibility. You men who have interested yourselves in industrial surgery are in a comparatively new field. The record you have made, measured by any standard in your profession or in the business world at large, is worthy of our best traditions.

But the field is large and the skilled laborers, comparatively speaking, are few. I doubt not that in the development of your work you will have the full co-operation of your profession as a whole and I know that I speak for the forward looking and right minded executive officers of the casualty insurance business when I say to you that you will have, too, from them in full measure the consideration, the co-operation, and the conscientious support which you and the cause you serve so fully justify.

THE VALUE OF MEDICAL SERVICE TO AN INSURANCE COMPANY[1]

F. HIGHLANDS BURNS, BALTIMORE
President, Maryland Casualty Company

FIRST allow me to express my appreciation of the honor done me, and for the opportunity given me in being invited to say a few words to such a distinguished body. Being a layman, I confess to a feeling of embarrassment, but because I am a layman, and very much interested in the surgical side of the medical profession, I hope I may be able to present to you a viewpoint which you may not have stressed in your daily activities.

Since the majority of those injured in industry receive the benefits of workmen's compensation legislation, and since the casualty companies play such a conspicuous part in making the workmen's compensation laws effective, my interest in the treatment of traumatic cases can be readily understood.

The company of which I have the honor to be president, expended in 1928, $1,578,302.00 for surgical and hospital fees in the treatment of industrial injuries under workmen's compensation policies alone, and $130,000.00 more in medical fees under policies other than workmen's compensation. If all the other companies paid in the same proportion, they would have paid the substantial sum of $27,000,000 in 1928 to the medical profession under workmen's compensation policies alone. I cite these facts to indicate to you that the insurance carriers are fully cognizant of the problems which confront them jointly with you in the big social problem which exists in the form of industrial accidents.

Fortunately, in the whole scheme of workmen's compensation insurance, a community of interests exists, which makes it possible and desirable for all factors involved to work in harmony. A claim arises because someone has been hurt. The amount of money paid in settlement of the claim is directly proportionate to the speed and degree of recovery. The employer's production depends upon the integrity of his force. The sooner his injured employees return to work, the better served are his interests. The injured man suffers the loss of a portion of his wages while he is disabled, so the sooner he gets back to work and the more completely he is restored to full wage earning capacity, the less poverty and want exist in his home. Thus the surgical care of the injured assumes a position of prime importance.

Through ignorance or lack of foresight, up to the time workmen's compensation went into effect in this country, the large majority of casualty companies did not take the interest in the question of surgical attention they should have. Under their policies, they were responsible for the

[1]Presented before the Conference on Traumatic Surgery, Clinical Congress of the American College of Surgeons, Chicago, October 14-18, 1929.

cost of the first aid only. The majority of companies did not recognize that a man who had received proper surgical attention and made 100 per cent recovery could not secure as large damages for which the companies were liable as one who had been treated by an unskilled practitioner and as a result, was left with a permanent disability. It also reluctantly forces me to say that the companies did not in those days look at it from the humanitarian standpoint as they should have done, but in defense of the companies it can be said that they did not have much choice as the injured was allowed to have any medical man he desired. In the large majority of cases he had his own doctor who in many cases was not a surgeon, much less a skilled one, the result being disastrous to the injured. If the number of cases could be known in which a simple injury resulted in death, the loss of a hand, an arm, a foot or leg, because of infection or other complications due to careless or ignorant surgical attention, we, I am sure, would be appalled.

Again I am sorry to have to admit that when workmen's compensation laws were first enacted, some of us at least did not recognize the importance, from either a humane or business standpoint, of seeing that the injured received the best surgical attention possible. I am glad to be able to say that that day has passed. The insurance companies and industry are rapidly getting the humanitarian viewpoint, and though large financial institutions are popularly supposed to be without heart or soul, they are still administered by human beings, and it, to me, would indicate an impossible callousness for us to fail to recognize the vast humanitarian aspect of the whole problem of industrial injuries, even before we grasp the financial significance.

We who are watching constantly the various phases of the workmen's compensation business, more particularly its medical aspects, feel a crying need for an improvement in hospital facilities for the care of traumatic cases. We appreciate this need perhaps better than you gentlemen who are actually on the firing line, because we are in a better position to view the problem in the abstract than are you. There are surprisingly few hospitals in this country who give any particular thought to the treatment of cases of traumatism. It is true that accident cases are well cared for in most of the hospitals, but apparently there is a failure to appreciate traumatic cases as presenting problems quite different scientifically and psychologically from those encountered in general surgical practice. In my own city of Baltimore, for example, I know of no hospital that maintains a ward devoted to the treatment and study of fractures. It would seem that the rather unusual conditions which present themselves in cases of injury resulting from accident, the varied forms of treatment which are necessary, not to speak of the rather peculiar psychology often encountered in accident victims, would lead the hospitals to provide special facilities for the care of such cases, not only from the standpoint of physical equipment but also in the creation of supervising mechanisms, a careful check-up on end-results, and thorough study of cases from a scientific standpoint.

There is a need, especially in our large industrial centers, for fracture wards and wards for the treatment of traumatic cases, equipped with the varied forms of appliances necessary in this day of modern surgery, providing opportunity for the practical education of medical students in traumatic surgery, and providing the facilities for the post-graduate instruction of graduates in medicine, who may feel the need of it, and of these there are many. There are many problems involving the questions of infection, of fractures and of other phases of injury which are still unsolved, and which offer productive fields for research. It is gratifying to see that interest in these matters is now being stimulated by the American College of Surgeons, and by a group of insurance carriers who have especially interested themselves in medical problems. Industry has thrust upon the medical profession a great burden and a great opportunity. Until now, to a certain extent, industry has failed to realize its own responsibilities in connection with the problem, but to no less extent has the medical profession also failed to grasp its true significance. Industry is now becoming conversant with the situation. The medical profession must work with industry in the provision of adequate care of the injured. It must realize that in participating in a field of activity which presents conditions and problems seldom met in the ordinary practice of medicine, it must undergo certain processes of readjustment. The medical profession will profit financially in its participation in the surgery and hygiene of industry, but it must adapt many of its traditions to circumstances which industry presents. Most of the difficulties which exist between the medical profession and industry, are based upon a misunderstanding of the situation, of one by the other, and often upon a stubborn refusal on the part of one party or the other, to attempt to reconcile conflicting views by yielding a point here and there.

The surgeon doing traumatic surgery must familiarize himself with the workmen's compensa-

tion laws. He is as much governed by those laws as the insurance carrier, the injured individual or the employer, and if he is going to participate in the whole scheme he must make himself an integral part of it in spirit and in practice.

The medical profession, largely through your efforts, gentlemen, is awakening to the enormous task which industry has imposed upon it, and I want to assure you that the insurance carriers are steadily coming to as full a realization as you gentlemen and are willing and anxious to work with you in bringing about a situation in which the injured workman is given the benefit of the skill of the finest qualified surgeons, so that his restoration to health and strength shall be rapid and complete.

Workmen's compensation legislation has definitely placed the responsibility for the human wear and tear of industry upon the industry, and through the industry, passes the cost on to the consumer. In administering the workmen's compensation laws, the principle of insurance is vitally necessary. In no other way than by the strong helping to bear the burdens of the weak, could this great humanitarian reform be accomplished.

I should like here to correct an impression which seems to be to some extent prevalent, which is that the insurance companies make a great deal of money out of their workmen's compensation business. Nothing could be farther from the facts. The premium rates, in the majority of the states, require the approval of the State authorities, and it has been our experience that in many states, although we could show from statistics that our rates were fully justified, for no fair reason, very often political, an arbitrary cut was made, sometimes as much as 20 per cent. In making the rates, we are allowed factors for the compensation payments, medical expenses, and the expense of putting the business on the books and administering it. Not one cent is allowed for profit. The only profit we are supposed to get is the interest earnings on the reserve we have to carry for unexpired business and unpaid losses. I assure you that in the past 10 years the companies' losses in the field of workmen's compensation have been very great. It may very readily be asked, if this is so, why do the companies continue to write it? For several reasons, one being the hope that the situation will improve, which it has done in the past 2 years, and another the realization that if it is given up the tremendous organizations the companies have to handle this business, built up at great expense of effort and money, would have to be scrapped, so with the optimism of youth we are looking to the next year to bring us some reward for our efforts.

The modern insurance company no longer considers it economy to organize its staff of surgeons on the basis of low fees. There is a sincere desire to give to the industrially injured the highest grade of surgical care that can be secured for him. Class consciousness still exists, and in many instances labor has been distrustful of the sincerity of employers and insurance carriers in this effort. Barriers of prejudice are being broken down, however, and as the years go by, we see a definitely increasing tendency on the part of workers to accept the good offices of employers or their insurance carriers, especially with reference to the treatment of injuries.

If the medical profession would only insist that industrial surgery occupy the same high ethical and professional plane that every other branch of the science does, and if insurance carriers and industry would come universally to the same conviction, each studying the problems of the other and trying sincerely and earnestly to meet them, most of the difficulties which now arise would be obviated. I want to ask you gentlemen to allow us to co-operate with you, to bring about this understanding and, as time goes on, we hope that our co-partnership in a great humanitarian endeavor will accomplish great things.

MEDICINE IN INDUSTRY

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IN THE few minutes allotted to me I cannot discuss the lack of adjustment that exists between medicine and society, nor is it necessary to do so.

The remarks of many of the distinguished speakers on the program have already touched upon this important subject and these may be taken as an index of a widespread realization that, while medicine as a profession has more than lived up to its best traditions of self-sacrifice, devotion, and scientific endeavor, it has signally failed to adjust itself to the economic demands of society and particularly that part of society which is represented by industry.

Society, in other words, is fully satisfied with what medicine has made itself capable of doing, but is utterly dissatisfied with its efforts—or rather its lack of effort—to transform its potential capacities into productive results.

The American College of Surgeons has set aside this day to search for ways and means of adjusting medicine to the needs of one particular class of society, i.e., the working industrial class. It shall be my endeavor to point out wherein the lack of adjustment lies and to suggest a means whereby a proper adjustment may be effected.

The object we seek is to give adequate medical service to injured workmen, but if we think of the problem in terms of the individual relationship between doctor and patient we shall end just where we started. The solution of the problem of how to benefit the injured workman is to be found only in a contemplation of the relation of medicine to the organizations which employ workmen and the organizations which exist to provide relief for workmen when they are injured.

The organization-complex, which is supposed to be created by the workmen's compensation acts, is the typical organization of relief. The employer, who insures his compensation risk with a carrier is the typical employer. There are half a hundred compensation laws in the various states, but the Texas law may be considered as typical.

To simplify our problem let us confine our study to the relation of medicine to the Texas employer and his carrier in Texas, in their united effort to create an organization-complex for the benefit of injured workmen.

The Texas Compensation Act, in common with all other organic laws, implies that an organization-complex shall be effected by certain factors which it designates to execute its purpose. A Board is provided for by law to administer the Act. These factors are as follows:

1. An organized body called the Employer which is held responsible by the Board for a report on every injury. If it fails to do so, it is held to account and is subject to a large fine.

2. An organized body called the Carrier which must provide medical service to the injured, must pay a weekly compensation, and must pay a specific amount of money to the injured man when permanently disabled. The Board holds the Carrier to a strict accountability for its acts.

3. An unorganized body of individuals—doctors—which is theoretically accountable to the Carrier, but which is in fact not responsible to anyone and which is in fact not accountable to anyone.

An organization cannot be said to exist unless it is a co-operative body acting under a single directing head. Is it not proper, therefore, to say that the intent of the Compensation Act to create an organization-complex for the protection of the injured man in industry has utterly failed in that no control can be exercised over the doctor who is the chief active agent of medical relief?

Is it not a fact that the doctor in industry is not responsible to anyone and also that he cannot be held accountable by anyone?

a. Can the injured man hold him responsible? No. The injured man does not pay the bill and he is such a humble member of society that the doctor need not consider for a moment his capacity to affect the doctor's standing in the community. The doctor need not consider any protest made by the injured man.

b. Can the Employer hold the doctor responsible? No. The Employer is not the paymaster and he has neither time to investigate the character of medical service rendered nor the ability to evaluate those services if he did investigate them.

c. Can the Carrier hold the doctor responsible? No. The law provides that the Carrier must furnish medical attention and must pay the bills, but there the matter ends. The dishonest doctor may and often does refuse even to make a report to the Carrier. In some cases he exhibits his individualism and manhood by refusing to send

the Carrier a bill which he refers to the Board for collection. There is no existing power which can compel the doctor to account to the Carrier.

d. Can the Board hold the doctor accountable? No. The Board has no power to compel any service from the doctor, nor can it call him to account. The Board may take the injured man out of the doctor's hands and it may require the Carrier to pay the doctor's bill, but there its power ends.

e. Can the Courts hold the doctor responsible? Yes, if a suit is entered against him for malpractice, but the Carrier is the only one who is in a position to enter such a suit, and he may carry the doctor's liability risk!

f. Can a doctor hold himself responsible and accountable? The answer is *Yes*. The conscience of the best doctors does hold them responsible and these doctors will willingly account for their acts. But all doctors are not the best doctors.

Society, as represented by industry, demands from medicine that it shall make its contribution to the organized effort of modern life and the answer to that demand has been that medicine will be responsible for service when it pleases and will render an account when it pleases.

Is it strange, therefore, that industry finds its medical service inefficient and expensive? Is it strange that the injured are not receiving proper care? Is it strange that carriers are actually losing money in the compensation departments of their business? Is it strange that organized labor and society at large are demanding in the name of humanity that the injured workman shall have a better chance to recover his ability to make a living? Is it strange that quacks and incompetents get hold of so many injured men? Is it strange that this lack of organization of medical service has brought about a condition whereby the misery of injured workmen is subject to an unholy exploitation by charlatans and shysters? It would be strange indeed if medicine's lack of organized effort had not created these conditions and it is amazing that labor, capital, and society at large have not long ago demanded, as they are now demanding, that medicine shall either organize itself for economic service, or be organized by others.

HOW CAN MEDICINE BE ORGANIZED FOR SERVICE IN INDUSTRY?

I will remind my audience again that we are limiting our discussion to a consideration of industry as it exists in a single state, Texas, and as it exists under the provisions of the Texas compensation laws. The principles involved in our discussion apply, however, to the whole field of industry, although other industries, such as the railroads which carry their own insurance, and industries in other States, all of which have different compensation laws, may require different methods in applying these principles.

In Texas, as we have already stated, there are three factors concerned in the organization-complex which the Compensation Act relies upon to give relief to injured workmen. These are employer, carrier, and doctor. We have stated that the employer and carrier are held accountable by the Board and that the doctor, who is now independent of all control, must be made a responsible factor in this organization-complex which the law intends to create for the execution of its declared purpose. Until this has been accomplished no real organization-complex can exist. To answer our question, medicine can be brought into the organization-complex created by the compensation law—

1. By an amendment of the law which would provide for state control of medicine. This is a form of *compulsory* organization which offends the dignity of medicine and is altogether a humiliating proposal.

2. By an organization created by the employer. This is a form of *compulsory* organization which must depend upon salaries paid to doctors to bind them to the organization. This form of organization may be practicable under certain conditions, but it is not possible under the provisions of the compensation acts where the carrier is the paymaster.

3. By an organization created by the carrier. As the carrier's business is scattered and shifting in character, it is not practicable to consider the formation of any organization bound together by payment of salaries. The carrier, therefore, is limited to a paper appointment of doctors to whom it requests the employer to refer the injured. This is an organization by *persuasion* and its efficiency depends entirely upon the co-operation the carrier is able to build up by tact, diligence, and persuasion. This is the common form of organization now existing in industry, but it is in fact no organization, because in its final analysis the doctor assumes only the responsibility he wants to assume and is accountable only when he wishes to be accountable. The existence of this Board on Traumatic Surgery and the fact that we are gathered together in conference today to devise ways and means to benefit the injured workman, are proof that this organization by persuasion is not satisfactory.

As a matter of fact, such an attempt is unscientific and can be considered only as a make-

shift until such time as medicine can organize or be organized for service.

4. The final method whereby medicine can be made available to industry is the American method of organization by *self-determination.* Medicine is too fine, too competent, too efficient to permit of its duties being taken over by others. It is too proud to serve under a master and it deserves a better fate than that of loss of independence.

The solution of the problem of medicine as it relates to industry can be found, in my opinion, in an organization of doctors, created and controlled by doctors, which is competent to treat as an equal with the other factors concerned in the organization-complex created by the Compensation Act to care for injured workmen. This is the American method of accomplishing an American purpose.

There is but one way for us doctors to organize medicine for service in industry and that is to *do it.* Can doctors do this? My answer is that doctors are like other Americans in that they can create power and are fully able to provide checks and balances to prevent abuse of power and yet accomplish the object for which power was created.

Tentative plans have already been drawn up for the creation of a medical association in Texas which have not yet been submitted to the profession at large but which have been discussed with leading surgeons, leading lawyers, employers, and carriers. This is the first time these plans have been brought before the public.

It is planned that a body composed of the most honored and respected doctors in the state shall apply for the charter of an association formed primarily to guarantee adequate medical service to corporations, to the state, or to society when and where it is impracticable or impossible to secure, by individual contracts with doctors, cooperative and responsible service. The association would be empowered to charge for its services and to possess property; to publish a monthly medical magazine devoted to industrial surgery as a scientific study and to industry as it is mutually related to law, medicine, and industrial medical organization. It would be empowered to rent or build and to conduct a scientific industrial laboratory and to rent or build a hospital ward in which the scientific treatment and study of industrial diseases and injuries could be carried on. It would have the power to establish, either separately or in association with medical colleges, a course of medical instruction in laboratory, or practical, industrial medicine and surgery.

The immediate purpose of the association would be to offer its services to carriers to take over their entire medical problem. It would offer carriers the opportunity to make a single binding contract for medical service throughout the state to replace the present method of making individual contracts for service with thousands of doctors, none of whom is bound and none of whom can be held responsible and accountable.

To carry out its purpose the board of directors of the association would appoint a medical executive council, a medical director, and a business manager. It would then draw up a set of by-laws and rules to which all members of the association would subscribe. These rules would provide for co-operative action of the members under the supervision of the medical director. With these rules in force and with the supervision of all injured which the association could and would provide for, the association could and would safely permit any reputable doctor to join the association as a member. It would then be up to the association to see to it that no doctor should be permitted to attempt treatments beyond his professional capacity, or where hospital and nursing facilities were inadequate.

The Compensation Act provides that unless the carrier fails, refuses, or neglects to furnish medical service, no bills can be contracted in the carrier's name. It therefore follows that when the medical association has contracted with the carrier to furnish medical service and when this contract has been filed with the Industrial Board, it can rule out and refuse to pay incompetents and all others who are not members of the association.

Having organized a state-wide association, the medical association is then in a position to contract with carriers to take over their entire medical service. I will not go into the matter of furnishing bonds to the carrier, although this must be done.

The association could, in my opinion, reduce the cost of medical service to the carrier from 20 per cent to 25 per cent of its present cost within 2 or 3 years and, as to the cost of compensation payments and the cost of settlements for disability, its service should enable the carrier to effect a reduction of from 25 to 30 per cent of its present cost. This saving would result from decreased morbidity, decreased mortality, and permanent disability, but most of all from a decrease in fraudulent claims which are now costing huge sums to carriers by reason of the fact that there is no existing medical organization which

can be asked for an opinion which in court will outweigh and offset the evidence of purchasable false medical testimony. Several of the leading lawyers in Texas have pointed out that the proposed organization would at once place the whole profession of medicine on a higher plane of public esteem and would largely put an end to fraudulent suits and the quack doctor, upon whom the shyster lawyer depends for fraudulent testimony.

From the viewpoint of the profession, the proposed organization would be able to control the expenditure of large sums of money, much of which is now wasted by reason of the disorganized medical situation. Quacks and incompetents are making fortunes which should go to reputable, competent surgeons. Medical overhead of carriers now consumes large sums of money which can be saved when the single overhead of the organization takes care of the situation. The association could not only save vast sums for the carrier, but it would pay for medical services what each case is worth.

Such an organization means added dignity to medicine, added income to legitimate medicine, an increased opportunity to study and treat industrial diseases and injuries, and an opportunity for medicine to become a valued member of the economic world. Such an organization would, I repeat, be an American instrument to serve America in an American manner.

Such is a brief sketch of a proposed organization designed to make our profession a part and parcel of the modern world of organized effort and a more useful member of society.

It is my hope and my ambition that this body, the American College of Surgeons, may accept my suggestion that the College is in a position to make the advancement of medical economic organization a part of its declared program.

HOW THE PROGRAM OF THE BOARD ON TRAUMATIC SURGERY ACCOMMODATES ITSELF TO THE PROBLEMS OUTLINED

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Chairman, Board on Traumatic Surgery

CAN any program of the Board on Traumatic Surgery accommodate itself to the solution of the problems set forth in today's discussions?

This like many questions is easy to formulate and propound but the finding and the executing of the answer are much more difficult.

In today's discussions of the various phases and circumstances connected with traumatic surgery there has been some polite rhetoric but the clear and direct statement of facts has predominated. There have been shown a common understanding and a bond of community interest which argue well for the solving of at least some of the problems involved in securing better care for the injured. An optimistic feeling should prevail even though the difficulties of achievement are recognized.

The Board on Traumatic Surgery began its work 3 years ago. The object was to search for the facts, find the facts, analyze the facts, and arrange the facts to the end that they may be utilized in realizing some of the ideals for better care of the injured patient and in applying these ideals practically and effectively.

All of the research, all of the discussion indicate that there is no indiscretion in the conclusion that it is clear and unanswerable that the better, the more scientific, and the more intelligent management of the injured patient results in a greater economic saving for all concerned.

Some practical plan must be devised to supersede the present methods if we are to succeed in bettering existing conditions. How shall the Board proceed? The following campaign of attack is proposed.

1. Admittedly, the teaching of traumatic surgery in the medical schools during the past quarter of a century has not kept pace with the advancement in other branches of surgery. The amount of research devoted to injuries has been small and the follow-up system inadequate. If we are to have better traumatic surgery, then we must have medical men taught and trained in a manner commensurate with the demands that are made upon them. Contact with the deans of medical schools has been made and through their keen interest and ready co-operation the curriculum in several schools has been improved to meet this educational situation. One of the most important functions of the Board will be to continue to co-operate with the medical schools in this work.

2. Correlating with the Department for the Standardization of Hospitals, a concerted effort has been made during the past years to secure a more complete equipment both as to personnel and materials for the better care of the injured patient. The result of this activity has been most gratifying, has brought about an enormous improvement, and has shortened the stay of the patient in the Hospital by several days. The necessity and urgency for a continuance of this work cannot be overestimated.

3. The Board has adopted the policy of aiding the medical departments of large industries in every possible way and in this connection it has seemed wise to formulate a Standard for Medical Service and it will use every ethical and legitimate measure to secure its adoption. It is recognized, however, that many of the medical departments now existing exceed in their efficiency the Board's requirements.

Further, it is hoped that it will be possible to arrange for a group medical service that will be available to smaller industries so that they may have the efficient protection that the larger organizations now enjoy.

4. The significance and importance of the proper means for the transportation of the more seriously injured cannot be overstressed. The experience of the men working in France, the action of the Surgeon General in insisting upon the transferring of patients to distant centers where they could receive more competent supervision, and the present practice of railroad surgeons would appear to justify the assumption that the moving of patients is not harmful even over considerable distance. Only through the centralization of patients and the collection of a large number of traumatic cases for observation and study at a place where all phases of their condition can be recorded, is there any hope for advancement and improvement of the present methods of treatment. This centralization of cases is most essential and has a direct bearing upon the principal plans and program of the Board.

5. The list of approved competent surgeons capable of caring for the injured that is being com-

piled by the Department of Clinical Research of the College should be a valuable adjunct.

6. The Department of Clinical Research hopes to fulfill an important and constructive function in acting as a clearing house in the consideration and standardization of new and approved methods of surgical procedures in treatment.

7. It is becoming more and more evident that the work of the Board, like all endeavor for the advancement of human knowledge, must assume an educational character.

How can instruction tending toward better traumatic surgery be promoted? If this accomplishment is to be realized there must of necessity be established a large, comprehensive teaching center or clinic for the accurate observation and treatment of injured patients. Such a clinic would be possible only in a densely populated community. The efforts of the Board can be crowned with success only by the construction of a large hospital in a great city where an abundance of teaching material is available and where both undergraduates and postgraduates can be taught. Obviously, such a hospital and teaching center must be entirely free from any self-interested economic influence. Preferably, it should be connected with a great university and be utilized for teaching purposes by the medical department.

Such an arrangement would insure its activity as a teaching center in perpetuity. Primarily, the interest of the Board is the welfare of the patient, which policy fortunately co-ordinates with a general economic conservation; therefore, it would not seem too optimistic to believe that the building of this proposed large hospital for the exclusive use of traumatic cases is a practical possibility and not an idle vision or dream.

Financial support can be secured from many legitimate sources and because of the universal compensation laws such an institution might be made self-supporting. Time does not permit the amplification of the potential possibilities in the advancement of surgical knowledge that will accrue from the centralization of a large number of traumatic injuries. It needs no diagram to permit the visualization of what could be accomplished.

If the Board on Traumatic Surgery of the American College of Surgeons can consummate some such plan as outlined, it will have builded a permanent educational structure for the welfare of mankind. Without the realization of some such constructive, definite, practical plan for the advancement of surgical education, all of this discussion has a meaningless and hollow sound and will prove to be futile.

The Board will assume the responsibility for executing its conceived program and the work will go forward with an optimism and an enthusiasm which will bring success.

COMMITTEE AND DEPARTMENTAL REPORTS

DEPARTMENT OF CLINICAL RESEARCH

BOWMAN C. CROWELL, M.D., CHICAGO
Director of Clinical Research

DURING the year the Department of Clinical Research has been enlarged by the addition of the Committee on the Archives of Malignant Diseases, and it now comprises:

1. Committee on Bone Sarcoma
2. Committee on Treatment of Malignant Diseases with Radium and X-ray
3. Committee on Archives of Malignant Diseases
4. Committee on Fractures
5. Committee on Standardization of Clinical Laboratories
6. Board on Traumatic Surgery

The departmental work connected with the functions of these committees has been carried on by a staff consisting of the director, one investigator, and an office force of two, sometimes three, clerks.

Reports of the work of the committees will be presented by their respective chairmen, but I take this opportunity of summarizing the outstanding work of the year in this department which has the supervision and correlation of the scientific activities of the College.

An ever-increasing recognition of the work of the College in the cancer field has been a pleasing feature of the year's activities. This, in my opinion, justifies the establishment of a Cancer Division of the department, and I now make such recommendation to your Board. Three committees engaged on different phases of the cancer problem are able to summarize and make available present knowledge and experience gained from empiric sources and to contribute new facts as a result of their studies. The director represents the College on many committees of allied organizations engaged in the cancer problem, and his position will be strengthened if he be known as the representative of the Cancer Division of the College.

Progress in the work on Bone Sarcoma is evidenced by the following facts: registration of 91 cases and records of 100 more cases awaiting registration or placing on the "consultation list"; circulation of 525 cases among 31 interested persons; furnishing data for special studies to a number of students of the subject throughout the country; exhibits on the subject at several national meetings, numerous talks on the subject by the registrar at scientific meetings; and detailed studies of chondrosarcoma by the chairman and of Ewing's sarcoma by the registrar.

The Committee on the Treatment of Malignant Diseases with Radium and X-ray has published two five-year reports, and has participated in the establishment of cancer groups and cancer clinics in a number of cities that have been visited during the holding of the sectional meetings. The intimate contact that must be maintained with these groups will add materially to the work of the department, and should justify addition to its staff.

The Committee on the Archives of Malignant Diseases has held several meetings of its Chicago members for the purpose of organization of its work and is prepared to commence its activities as soon as a staff to carry on the work becomes available. Elaborate record blanks have been prepared for cancer of different organs, and the distribution of these should have a beneficial effect on the nature of the histories taken in cancer cases. If the work of this committee is successful the College will have available a mass of information on cancer cases that could be obtained in no other way, and that will ultimately justify some conclusions on the relation of heredity to the incidence of tumors.

The Board on Traumatic Surgery has published the results of surveys of the present methods of caring for the injured in New York City and Chicago. Based on this purely objective study by a trained investigator, a standard for medical and surgical service in industry has been evolved and will be submitted to this body for approval. State committees have furnished to the Board the names of over 2,200 surgeons, who, in their opinions, merit inclusion on the list of traumatic surgeons to be approved by the College. From other

sources the names of about ten thousand other surgeons doing traumatic surgery in one form or another have been obtained and will need careful investigation. A symposium on the subject of traumatic surgery has been prepared for this Congress.

By authorization of this Board a number of surgeons are being admitted to Fellowship in the College under the classification of "Surgical Administrators."

The Committee on Fractures has held its annual meeting which will be reported by its chairman. A new feature was added to the sectional meetings in the form of the presence of the chairman of the committee and his active participation in all of the meetings. At the cities visited, subgroups were formed to work in conjunction with the central committee and the names of these committees will be submitted to this Board for approval. A primer on the subject of fractures has neared completion, and a series of motion picture films on fractures is occupying the attention of the committee.

Emphasis was placed on the scientific work of the College at the Sectional Meetings, and this was facilitated greatly by the presence of members of the scientific committees. The attendance and interest of these members also made possible a very great extension of the influence and constructive program of the College work.

COMMITTEE ON THE TREATMENT OF MALIGNANT DISEASES

ROBERT B. GREENOUGH, M.D., F.A.C.S., BOSTON, Chairman

COMMITTEE

Robert B. Gr enough, Boston, Chairman
A. C. Broders, Rochester, Minn.
Curtis F. Burnam, Baltimore
George W. Crile, Cleveland
Bowman C. Crowell, Chicago
William Duane, Boston
Edwin C. Ernst, St. Louis
J. M. T. Finney, Baltimore
Burton J. Lee, New York
Frank W. Lynch, San Francisco
Robert T. Miller, Jr., Baltimore
H. A. Pancoast, Philadelphia
H. Gideon Wells, Chicago
Francis C. Wood, New York

I HAVE the honor to submit the following report of the Committee on the Treatment of Malignant Diseases with Radium and X-ray.

During the past year, five-year end-result reports were completed on cancer of the cervix and on cancer of the breast, and these reports were published in SURGERY, GYNECOLOGY AND OBSTETRICS in August, 1929. Preparation has been made to start the work of making abstract records of additional and more recent cases of these two diseases, together with abstract record of other cases of cancer of the rectum, colon, thyroid, and mouth.

In February and March, 1929, Dr. Burton J. Lee, as a representative of this committee, accompanied the other officers of the College to attend the sectional meetings of the American College of Surgeons in Texas, Arizona, California, Oregon, Washington, Minnesota, Nebraska, Saskatchewan, and Manitoba. Dr. Lee spoke at these meetings on the subject of cancer and of the work of the committee, and he was able to interest the Fellows of the College in many of the cities visited in the organization of special cancer groups and cancer clinics, in existing approved hospitals, for the improvement of cancer service in these communities, and for the development and collection of material for further investigation of this disease. Plans are now under consideration for the further organization and co-ordination of groups and clinics of this nature, a most significant step in the improvement of cancer service throughout the country, and one which promises more than anything else immediately available to diminish the excessive mortality which is associated with this disease.

SUPPLEMENTARY REPORT

In spite of world wide energetic research there is, at the present moment, no indication of the discovery of any specific cure for cancer, and it is fair to suppose that for many years to come our present methods of treatment, surgery and radiation, will be the main reliance in the treatment of the malignant diseases.

Although either of these methods may be effective and successful in the treatment of early cases of cancer, especially in its more accessible situations, in the late stages of the disease they are rarely of more than palliative value; and there is evidence to support the estimate that not more than 10 percent of all cases of cancer are today given treatment in this early and favorable stage.

Much has been done to teach the public the importance of early diagnosis, but until recently it has not been appreciated that in most of its situations the diagnosis of early cancer requires personal experience and material resources far in

excess of those available to the general practitioner to whom the vast majority of patients first appeal when their anxieties are aroused by symptoms which they have been taught to believe to be suggestive of cancer.

This is briefly the situation that confronts us today, and we must either sit idly by and watch the constantly increasing harvest of death from cancer, or we must take such steps as lie within our power to meet this serious situation.

Research laboratories and cancer institutes throughout the civilized world are working on this problem and little by little the sum total of our knowledge of cancer is increasing. Much is being done also by the American College of Surgeons as well as by other organizations, such as the American Society for the Control of Cancer, and through local, state, and national medical societies and public health departments to improve our present resources for treatment by surgery and by radiation. There have been great advances in these lines in recent years, but to meet the difficulty of early diagnosis, further and more effective methods must be made available to the general practitioner in the way of easy consultation service, or all our efforts must go for naught.

The successful handling of early cancer cases has become a very restricted special line of medical activity requiring in the last analysis, not one man, but a whole group of men acting in close co-operation and consultation. Too often the surgeon is unfamiliar with the results obtained by radiation and the radiologist with the results of surgery, while both in many cases are without the close co-operation of the skilled tumor pathologist who is so essential to the wise selection of treatment in the individual case today.

Cancer institutes and cancer hospitals are already in existence in many of our larger communities today. There is room for many more such institutions and they will undoubtedly come into existence as soon as funds sufficient for their maintenance can be secured. They must always, however, be relatively few in number and thus inaccessible without undue delay and expense to the masses of the population and the great majority of the medical profession.

To meet this need, cancer clinics, established as a part of already organized hospitals, have sprung into existence in many places. Some of these clinics owe their origin to the initiative of interested members of the hospital staff. In other cases, as in Massachusetts, their organization has been fostered by the State Department of Public Health; and again the American Society for the Control of Cancer, which has adopted the policy of development of cancer service, has had a share in the organization of clinics of this nature. At present there is no uniform co-ordinating agency in the development and maintenance of these clinics, but it would seem that such an agency is readily available in the American College of Surgeons.

The College already has a committee on the treatment of malignant diseases which has been engaged in promoting the more accurate and uniform recording of cancer cases, and in studying the comparative results of treatment.

It maintains the Registry of Bone Sarcoma and is undertaking the collection of data on heredity in the Archives of Malignant Diseases. All of these activities come under the Department of Clinical Research, and the organization of this department is amply qualified to take up this work. Provision can be made for a section meeting for those participating in cancer clinic work at the time of the annual meeting of the College, and another less formal meeting for the discussion of methods and policies could readily be held at some other time during the year, perhaps in connection with some of the sectional meetings of the college.

The provision of uniform record systems would greatly facilitate the collection of accurate data on cancer cases, and thus contribute to the work already undertaken by Committees of the College, and the *Bulletin* could be utilized to maintain close co-ordination of these clinic activities.

In the opinion of the committee on the treatment of malignant diseases, this is a suitable and a desirable project for the American College of Surgeons to undertake. From the point of view of initial expense the cost to the College should be very slight,—limited indeed, to the increased labor required from the Department of Clinical Research. The clinics will be organized only in existing hospitals which have a sufficient professional talent and material resources to carry on the work successfully. Additional expense involved in conducting the clinics will have to be carried as it should be by the community they serve. The College will lend only the weight of its authority in promoting the principles involved in giving better cancer service to the community, and will offer a medium for co-ordination of effort and for maintenance of interest which will help the clinics to establish and improve their service.

The directors of the American Society for the Control of Cancer which is committed to the policy of measures such as this to improve cancer service, have passed a formal vote in approval

REGENTS AND OFFICERS OF THE AMERICAN COLLEGE OF SURGEONS

Seated (left to right): Robert B. Greenough, Ernst A. Sommer, Miles F. Porter, Major General Merritte W. Ireland, President; Franklin H. Martin, Director General; George D. Stewart, G. A. B. Addy, Edward Martin. Standing (left to right): J. Bentley Squier, Charles H. Mayo, George W. Crile, Fred B. Lund, Perry G. Goldsmith, J. M. T. Finney, Allen B. Kanavel, Frederic A. Besley, Irvin Abell, C. Jeff Miller, W. W. Pearson, Admiral Cary T. Grayson, Bowman C. Crowell.

of the plan for the American College of Surgeons to take this action if they are disposed to do so.

Your committee recommends, therefore:

1. That the Board of Regents approve this plan for promoting cancer service in existing hospitals.
2. That the name of the committee on the treatment of malignant diseases with radium and X-ray be changed to read "The Committee on the Treatment of Malignant Diseases."
3. That to this committee be entrusted the details of carrying out this plan and that an executive committee of six of the members of the above committee be constituted to work with the director of Clinical Research on the detailed methods to be employed.
4. That the director of the Department of Clinical Research be authorized to act as executive officer of this committee, and that a sufficient appropriation be made to his department to make it possible to carry on this work effectively.

COMMITTEE ON THE TREATMENT OF FRACTURES

CHARLES L. SCUDDER, M.D., F.A.C.S., BOSTON, Chairman

COMMITTEE

Charles L. Scudder, Boston, Chairman
Nathaniel Allison, Boston
A. P. C. Ashhurst, Philadelphia
Frederic W. Bancroft, New York
L. E. Barnett, Dunedin
Willis Campbell, Memphis
Isidore Cohn, New Orleans
H. Earle Conwell, Birmingham
Salvador Cordoba, Venezuela
F. J. Cotton, Boston
William Darrach, New York
Frank D. Dickson, Kansas City, Mo.
E. L. Eliason, Philadelphia
William L. Estes, Bethlehem
W. E. Gallie, Toronto
F. B. Gurd, Montreal
G. W. Hawley, Bridgeport
Melvin Henderson, Rochester, Minn.
Paul B. Magnuson, Chicago
Lloyd Noland, Birmingham
W. O'Neill Sherman, Pittsburgh
E. A. Sommer, Portland
Kellogg Speed, Chicago
Jorge del Toro, Porto Rico
J. B. Walker, New York
John C. Wilson, Los Angeles
Philip Wilson, Boston

I HAVE the honor to present to the Board of Regents this, the sixth annual report of the fracture committee. The educational work of the committee has progressed satisfactorily.

The *Fracture Primer*, essentially completed, has been submitted for publication and, after careful editing, will be published in the official organ of the College. The committee recognizes that the *Primer* will occasionally require revision and this task will be a perennial one.

Graduate instruction. A special fracture course given at the Massachusetts General Hospital, Boston, October 3 to 8 inclusive, 1928, was attended by one hundred and thirty-one surgeons from all parts of the United States and Canada. I have just come from a similar course on fractures given in Boston, completed Saturday evening, October 12.

Such intensive courses serve as stimuli and examples to surgeons in other clinical centers. Similar courses are being contemplated in other cities under your committee's supervision. In Boston the participants giving the courses were members of the New England Regional Committee of the College.

Undergraduate work. We are in direct communication with the professors of surgery in A Grade medical schools. Dr. William Darrach, chairman of our subcommittee, addresses the Association of American Medical Colleges at its annual meeting in New York this month, on instruction in fractures helpful to undergraduates. In view of the reorganization of the Presbyterian Hospital Fracture Unit at Columbia University, this address will be a constructive contribution.

The fracture motion picture. The first draft of the scenario on the treatment of fractures has been completed. The adaptation of the scenario is being perfected and those in charge of the production of the motion picture are in conference. The work is necessarily progressing slowly, but well.

Inspection tour. At the invitation of the College, the chairman of your committee was able to attend the regional meetings of the College the past winter and spring. The scope and accomplishments of this tour so far as fracture treatment is concerned have been reported elsewhere.[1] Suffice it to say here that great interest was manifest in fractures throughout the country visited, and the names of the personnel of these committees will be presented to you for confirmation. Nineteen regional committee groups were formed. A more leisurely and thorough inspection of the fracture situation will undoubtedly result in even greater benefit.

Steel bone plates and screws. The fracture committee would like to be instructed as to the wishes of the College with regard to activity in connection with the standardization of steel bone plates and screws used in fracture work. Copy of

[1] Surg., Gynec. & Obst., 1929, xlix, 406.

the report of the subcommittee was submitted to the regents.

New members. Certain new names have been proposed for membership in the committee and these, of course, will be presented in the written report. Dr. Joseph Blake has retired and so has resigned. Dr. A. F. Jonas, Omaha, is seriously ill and has retired.

As an example of the activities of members of our committee, the fracture exhibits at the recent meeting of the American Medical Association in Portland, Oregon, should be mentioned. These exhibits were supervised by a committee consisting of Drs. Speed, Allison, and Darrach, with the assistance of an advisory committee.

Your committee is interested in appointing fellows to have charge of fracture exhibits at the several regional meetings of the College throughout the year. The personnel of these local committees will necessarily vary according to the place of the meeting. Dr. Kellogg Speed has charge of the demonstration at the present meeting in Chicago.

The fact should be recorded that the Rockefeller Foundation has co-operated in furtherance of good fracture records by publishing a complete statement, illustrated, of the record form used at the Massachusetts General Hospital. A reprint of this article will be mailed to A Grade hospitals. The College has offered to provide its address list for mailing these reprints.

The chairman of your committee this Spring attended the meeting of the American Railway Association, Medical and Surgical Section, in Virginia. The relation of the railway surgeon to fracture treatment was discussed. As a result of contact with this important group of surgeons, this association appointed a committee to co-operate with the fracture committee of the College in improving the treatment of fractures. Dr. Guthrie, of Sayre, Pennsylvania, is chairman of this committee.

REGISTRY OF BONE SARCOMA

BOWMAN C. CROWELL, M.D., CHICAGO, REGISTRAR

COMMITTEE

Dallas B. Phemister, Chicago, Chairman
Bowman C. Crowell, Chicago, Registrar
Edwin I. Bartlett, San Francisco
Joseph C. Bloodgood, Baltimore
Barney Brooks, St. Louis
E. A. Codman, Boston
C. L. Connor, San Francisco
James Ewing, New York
W. R. Galbreath, Porto Rico
Frank W. Hartman, Detroit
Henry W. Meyerding, Rochester, Minn.
J. J. Morton, Rochester, N. Y.
Luis Razetti, Venezuela
Channing C. Simmons, Boston

SINCE October 1, 1928, one hundred ninety-three cases have been received by the Registry, of which ninety-one have been registered. Of the remainder some will be registered and some placed on the "consultation" list. Four hundred eighty-five registered and forty-four unregistered cases have been circulated among thirty-one interested persons. There is a constantly increasing demand for groups of cases for study. One hundred seventy-three follow-up letters covering three hundred forty-eight living cases have been sent out to the surgeons registering the cases.

The present cases in the Registry fall under the following headings:

Osteogenic sarcoma	445
Benign giant cell tumor	220
Ewing's sarcoma	102
Myelomata	28
Metastatic tumors	32
Benign osteogenic tumors	24
Inflammation	57
Extraperiosteal fibrosarcoma	19
Angiomata	9
Angio-endotheliomata	6
Unclassified and miscellaneous	36
Giant cell tumor—malignant	5
Not bone tumors	18
Withdrawn	4
	1005

There have been exhibits on the subject of bone sarcoma at several national meetings, talks on the subject by the registrar at scientific meetings, and detailed studies on chondrosarcoma by the chairman and by the registrar on Ewing's sarcoma.

THE BOARD ON TRAUMATIC SURGERY

FREDERIC A. BESLEY, M.D., F.A.C.S., WAUKEGAN, ILLINOIS, Chairman

COMMITTEE

Frederic A. Besley, Waukegan, Illinois, Chairman
Bowman C. Crowell, Secretary
John E. Bacon, Miami, Arizona
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Leo Dretzka, Detroit
Donald Guthrie, Sayre
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Loyal A. Shoudy, Bethlehem
Ernst A. Sommer, Portland
Frederick J. Tees, Montreal
John B. Walker, New York

IT is believed that the work of the Board on Traumatic Surgery has gone forward during the past year with steady and constructive progress and is becoming one of the important activities of the College. The progress has been made possible only through the far reaching vision of Franklin Martin, the Director General, who has recognized and supplied the material means for its accomplishments. It will be recalled that the original Research Group was appointed in 1926 and made its first report at Montreal.

Recognizing the necessity of obtaining first hand information and securing the real facts regarding the practice of traumatic surgery in all its relationships, which includes the injured patient, the employer, the hospital, and the insurance carrier, a comprehensive survey was made in the situations as they exist in New York, Chicago, and the oil fields of Oklahoma. These surveys were made by Earl W. Williamson. His carefully prepared reports and his well thought out summary and suggestions will be found in the June, 1929, and September, 1929, *Bulletins of the American College of Surgeons*. This accurate information forms a substantial foundation for deductions and conclusions upon which to base an intelligent program for future activities.

MEDICAL EDUCATION

It was realized that all real progress in the care of the injured depends upon improvement in the teaching of this subject and in emphasis placed upon it in the curricula of the medical schools, with post-graduate courses as well. At the instigation of the Board on Traumatic Surgery, this subject was presented at the 1928 meeting of the American Association of Medical Colleges held at Indianapolis, and a committee of that organization has been appointed, whose duty it is to see that emphasis is placed upon the teaching of the subject of traumatic surgery in the curricula of the surgical departments of the medical schools. The future influence that this will have cannot be overemphasized.

Obviously a state license to practice medicine is not always indicative of the ability and qualifications necessary to do competent traumatic surgery, and in this connection it may be fairly stated that all hospitals are not adequately equipped for the proper care of the injured. An attempt is being made by the Board to form a list of competent men throughout the United States who are eminently qualified to treat traumatic cases. State committees have been appointed to aid in securing this information and additional data regarding these men is being secured from hospitals, employers, and insurance carriers, and surgeons associated with large industries.

This information is being accumulated at the Clinical Research Department of the College and indexed on cards. At the present time there are listed the names of approximately 12,000 whose credentials and qualifications are known. Of these men, 8,624 are not members of the College. A large part of this information relative to their competency has been secured from the hospitals where they do their work.

Many requests have been made by employers of large numbers of workers as to what constitutes a proper medical set up for the prevention of accidents and sickness and the proper care of the injured.

Hospitals desire and require instructions regarding the necessary adequate equipment for the best care of the injured. Insurance carriers are evincing an ever-increasing interest in the activities of the College in traumatic surgery and are willing to co-operate in the plans to secure better care for the injured. To meet this situation the Board on Traumatic Surgery is endeavoring to establish a high standard of proficiency for the prevention of accidents and sickness and the ultimate care of the injured and to utilize every ethical and legitimate means to secure the adoption of such a standard.

The Board on Traumatic Surgery at its meeting October 13 adopted the following standard:

STANDARD FOR MEDICAL SERVICE

This standard is to be required of industries, hospitals, insurance carriers, and others desiring recognition and approval by the College.

1. A medical department devoted to the care of the injured shall be under the direction of a carefully selected physician who is responsible for the administration of the service and for the professional care of patients, subject to the approval of the governing body of the department. The personnel shall consist of at least: (a) a competent physician, (b) a trained nurse, or the equivalent, (c) a consulting staff of specialists officially appointed to advise and participate in the treatment of special cases.

2. The management of the medical department shall adopt rules and regulations governing the policies and the professional work of the department. These rules and regulations shall provide (a) that the principles of the Standard for Medical Service be adopted, (b) that there shall be prepared a monthly report which summarizes the nature and extent of the injuries and the results of their treatment.

3. Facilities for the treatment of the injured shall consists of (a) an efficient transportation service, (b) a casualty department in a hospital consisting of receiving, operating, and recovery rooms adequately equipped for diagnosis and treatment, with accessible clinical laboratory, X-ray, and physical therapy services, all under competent medical supervision, (c) a system of case records filed accessibly and cross indexed—a complete case record being one which includes identification data; cause of accident; nature and extent of the injury with detailed physical findings; special examinations, such as consultations, clinical laboratory and X-ray; tentative diagnosis and prognosis with an estimated period of disability; progress notes and subsequent treatment; final diagnosis; condition on discharge; end-results, and additional information required by law in the case of a claimant for Workmen's Compensation.

4. Physicians designated to treat traumatic cases shall be (a) graduates of medicine in good standing and legally licensed to practice in the state or province; (b) competent in the practice of traumatic surgery; (c) worthy in character and in matters of professional ethics—in this latter connection the division of fees, under any guise whatsoever, shall be prohibited; and (d) familiar with the principles of compensation law and contract.

5. Medical departments shall fulfill the requirements of the Workmen's Compensation law when treating employees of industry.

6. A hospital which maintains a department for the treatment of traumatic cases shall meet the Minimum Standard of the American College of Surgeons.

7. Sanitary conditions, accident prevention measures, and health supervision of employees shall be provided for in industrial and commercial establishments and in so far as possible to be under the general supervision of the medical department head.

At all of the sectional meetings of the College in the United States and Canada, the various phases of traumatic surgery have been discussed with interest and profit. The interest that the discussions of this subject has elicited at these meetings is worthy of comment.

It would be unfair to terminate this report without recognition of the thoughtful, untiring industry and meticulous attention to detail of Dr. Bowman C. Crowell, secretary of the Board. He has made its work possible.

STATE AND PROVINCIAL SECTIONAL MEETINGS

THE addition of certain features to the College activities with relation to the sectional meetings in 1929 served to arouse greater interest in them and to enhance their value. Representatives of the scientific committees of the Department of Clinical Research attended all meetings under authorization of the Board of Regents. In addition to presenting the work of their respective committees to the Fellows of the College, these representatives formed local subcommittees to function in association with the Central Committees. In the intervals between the formal sectional meetings the groups of visiting officials visited other cities where they presented programs before the local county medical societies, visited the medical institutions, and also formed local subcommittees. The work on fractures, cancer, and bone sarcoma thus received an additional impetus and increased its usefulness.

The hospital program was expanded to include practical demonstrations and discussions in the hospitals, where local and general problems were discussed to the advantage and interest of all. A notable and pleasing feature of these meetings was a larger attendance of hospital trustees and their active participation in the program.

The following sectional meetings have been held in 1929:

Arizona, New Mexico, Texas—Phoenix, February 13–14
California, Nevada—Los Angeles, February 18–19
British Columbia, Washington, Oregon—Vancouver, February 27–28
Alberta, Saskatchewan—Regina, March 4–5
Minnesota, North Dakota, South Dakota—Minneapolis, March 11–12
Nebraska—Lincoln, March 14–15
A clinical day and public meeting for Manitoba was held at Winnipeg, March 7–8

In addition to the meetings just listed, programs were furnished for the following County Medical Societies:

El Paso County, Texas—El Paso, February 11
San Diego County, California—San Diego, February 15
San Francisco County, California—San Francisco, February 21
Portland City and County, Oregon—Portland, February 23
King County, Washington, Seattle, February 25

The visiting speakers at these meetings included: Drs. Alfred W. Adson, Rochester; Donald C. Balfour, Rochester; Bowman C. Crowell, Chicago; Carl H. Davis, Milwaukee; Allen B. Kanavel, Chicago; Philip H. Kreuscher, Chicago; Burton J. Lee, New York; William E. Lower, Cleveland; Malcolm T. MacEachern, Chicago; Franklin H. Martin, Chicago; Charles H. Mayo, Rochester; W. W. Pearson, Des Moines; Charles L. Scudder, Boston; Rev. C. B. Moulinier, S.J., Chicago; and Mr. Robert Jolly, Houston.

REPORT OF THE BOARD ON MEDICAL MOTION PICTURE FILMS

THE Board has continued the work of surveying existing medical films for the purpose of securing information as to what films are available, where they can be obtained, and whether or not they are satisfactory for teaching purposes. About 250 reels of such film have been reviewed and catalogued at the office of the Board in Chicago.

To accomplish the purpose for which the Board was established, new films on practically every subject pertaining to medicine must be made. Leaders in the various branches of medicine, The Board of the College, and the Eastman Teaching Films, Inc., are co-operating in the production of these films. Fifteen have been completed and approved, and copies of eight of these have been released for distribution. The others will be ready for release very shortly.

APPROVED FILMS READY FOR DISTRIBUTION

The Diagnosis and Treatment of Infections of the Hand (*3 reels*). By Dr. Allen B. Kanavel.

Benign Prostatic Hypertrophy (*1 reel*). By Dr. J. Bentley Squier.

The Technique of Blood Transfusion (*2 reels*). Made at the University of Rochester Medical School.

Indirect Inguinal Hernia (*3 reels*). By Dr. Daniel LeRay Borden, Washington.

Simple Goiter (*1 reel*). By Dr. George W. Crile.

Ectopic Heart (*1 reel*). Photographed at the Kansas City General Hospital.

Rabies (*1 reel*). Photographed at Cook County Hospital by Dr. Julius H. Hess.

Intestinal Peristalsis (*1 reel*). Photographed at the Mayo Clinic by Drs. Walter C. Alvarez and Arnold Zimmerman.

APPROVED FILMS WHICH WILL BE RELEASED FOR DISTRIBUTION SOON

Amyotonia Congenita (*1 reel*). An existing film which has been revised.

The Normal Heart (*1 reel*). An existing film which has been revised.

Treatment of Normal Breech Presentation (*2 reels*). By Dr. Joseph B. DeLee.

Acute Appendicitis (*1 reel*)—For the Public. By Dr. Edward Martin.

Acute Appendicitis (*2 reels*)—For the Profession. By Dr. Edward Martin.

Tests of Vestibular Function (*1 reel*). By Dr. Richard H. Lyman, Rochester, N. Y.

Development of the Fertilized of the Rabbit's Ovum (*1 reel*). By Dr. Warren H. Lewis, Baltimore.

All of the approved films listed in these two groups were shown at the meeting in Chicago.

NEW FILMS IN PROCESS OF PRODUCTION

Fracture Film (*5 or 6 reels*). By the Fracture Committee of the College.

Water Pollution in Hospitals (*2 reels*). By Dr. Arnold H. Kegel, Chicago.

Hospital Standardization (*2 reels*). By Dr. Malcolm T. MacEachern, Chicago.

Cardiac Irregularities (*3 reels*). By Dr. Carl J. Wiggers, Cleveland.

Surgical Treatment of Pulmonary Tuberculosis (*2 reels*). By Dr. C. A. Hedblom, Chicago.

Massive Atelectasis (*2 reels*). By Dr. Walter Estell Lee, Philadelphia.

Preliminary scenarios have been written for two or three other films, and a number of pictures showing operative technique have also been planned.

A pamphlet prepared under the supervision of the Board, containing detailed descriptions of all approved films, is being sent out to medical societies, medical schools, hospitals, and Fellows of the College.

The production of the films already completed under our program has involved much experimental work in relation to such phases as lighting of operative fields, building of special cameras for photographing animated drawings, and perfecting the use of panchromatic film and color filters to eliminate blood from the operative field. Everyone connected with the development of the work has gained much valuable experience, as a result of which future film productions will require less time and more satisfactory results can be accomplished.

The whole idea of utilizing motion picture films for teaching medicine and surgery has been given added impetus by the keen interest shown in the films exhibited at the meeting of the Clinical Congress in Chicago. Demonstrations made at that time of talking films resulted in much discussion of the possibilities of this method of teaching. It is the general opinion that the scope of the silent film is immeasurably widened by the addition of sound. Colored films shown at the meeting also offer interesting possibilities for further development.

THE LIBRARY AND LITERARY RESEARCH DEPARTMENT

WHEN the College Library was initiated a research staff was organized to make this Library of use to Fellows of the College and to members of the medical profession in general. The development of the Library through each succeeding year has been accompanied by an even greater development in the service furnished by the associated Department of Literary Research. Requests are received from foreign countries as well as from all parts of the United States and material goes out by every mail, emergencies being met by telegram and air mail. For one doctor supplied with information in the reading room there are some two hundred served at a distance from the College Library. In each instance a definite outline of the doctor's requirements is followed, and according to this outline the work varies from the furnishing of a few references to the most comprehensive study of the subject. The service covers the compilation of bibliographies and the preparation of abstracts and translations or complete reviews of the literature to assist the doctor in his clinical work, in his experimental investigations, or in the writing of his medical and surgical papers. Manuscripts of medical papers and books are edited and indices prepared of books ready for publication.

The loaning of books from the Library is reduced to a minimum because the College collection is required for the great amount of research work done in the College Library and also because most of the loan requirements are met by the reprint material in the College Package library.

The Package Library is a classified collection of reprints and clippings from journals, selections from which are loaned on practically every subject put in work in the Department, and this section is in addition to the usual collection of books and journals. Another division, more important still, is the file of bibliographies, abstracts, and translations that have been compiled since the Department and the Library were established some eight years ago.

The emphasis placed on service has definitely shaped the character of the medical library, not only of the College Library but of local libraries in hospitals and clinics that have become more or less closely associated with the central Library. It has also brought a new type of worker into the field, the librarian who sees, not merely a collection of books to be catalogued and cared for, but a fund of information which must be continually worked over to be made of practical use.

The College Library affords a training center for such librarians and continues to co-operate with them after they are in local service by furnishing material to complete the local library and by furnishing translations, editorial assistance, and help along any line that cannot be fully covered by the local librarian or research worker. Thus in addition to supplying the individual doctors directly, the College Library and Department of Literary Research serves indirectly by supplementing the work in hospital libraries, or the library and editorial departments of clinics.

The central Library must be more complete and the staff more comprehensive than in a local library. Because of the number and variety of requests received at the College, the Library has use for historical and other material that would be out of place and practically useless in the smaller local libraries where the limited space is filled with the most useful and recent selections.

In the same way the research staff, at first including among their full time members only workers in English, German, and French, now

translates from many languages—Dutch, Spanish, Italian, the Scandinavian languages, Bohemian, Polish, and Russian—considerable work being required in the languages of less importance in medical literature because of the broad field served by the College.

Co-operation with hospital libraries has become much more extensive during the past year. Representatives of hospitals have been given aid in establishing libraries in hospitals or, perhaps more important still, in planning for a more active service from a hospital library already established but more or less dormant. In hospitals where library service has been encouraged subjects have been selected for study and compilations have been made from the hospital case records combined with reviews of comparable data from the literature. The librarian furnishes information in connection with unusual cases in the hospital, answers questions from the laboratory, and is an important factor in the review of interesting cases or series of cases in the hospital staff meeting.

There are many opportunities for exchange of duplicate material between the College Library and the hospital library to the advantage of both. This coming year there will be published regularly in the *Bulletin* of the College a list of duplicates that can be furnished to hospitals and other libraries as exchange material and also a list of books especially needed in the College Library including bound journals required to complete files.

Instead of one or more outstanding gifts to the College Library during the past year, there have been smaller acquisitions too great in number to permit of listing in the available space. This is partly due to the fact that the Library has reached the stage where any extensive collection offered to the College is largely a duplication so that only a few volumes can be accepted from one source. There have been contributions from a larger number of the Fellows than ever before, the additions in many cases being the very latest publications and therefore most valuable in our research work.

The College Library should have a complete collection of the works of the Fellows of the College including two copies of all reprints for the Package Library section. Fellows of the College, especially those entering this year, are asked to send in copies of their books and articles and to keep such collections complete by the addition of new material as it comes from the press.

GREETINGS FROM THE COLLEGE OF SURGEONS OF AUSTRALASIA

DR. JOHN NEWMAN MORRIS, Melbourne, Australia: Mr. President and Fellows of the American College of Surgeons: It is my privilege to convey to you today official greetings from the Executive Committee and a message of very heartfelt good will from the Fellows and members of the College of Surgeons of Australasia, which includes New Zealand.

CHICAGO COMMITTEE ON ARRANGEMENTS

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HOSPITAL STANDARDIZATION CONFERENCE

REPORT OF 1929 CONFERENCE IN CHICAGO

AN abstract of the papers and discussions presented at the Hospital Standardization Conference held during the Clinical Congress of the American College of Surgeons in Chicago, October 14–18, 1929, is presented in the following pages. Franklin H. Martin, M.D., Chicago, president of the College, presided. The distinguished guests were introduced by Surgeon-General Merritte W. Ireland, Washington, D.C., president-elect of the College.

ADDRESS OF WELCOME

ARNOLD H. KEGEL, M.D., Chicago: Chicago is proud to have as its guests those who personify our highest ideals, the standard bearers of conscientious surgical practice and better hospitals. As a surgeon and as Commissioner of Health of the City of Chicago I extend to you welcome. Those of us who more recently have entered the field express our appreciation to the American College of Surgeons for our excellent training, for the criteria set for our education, for yardsticks of ethics and conduct in practice, for standards of professional aims and competency, and for efficient, well equipped, and well managed hospitals. As the need for competent surgery, for standardized hospitals, and for health inventoria is filled other problems will be taken in hand. A definite policy as to procedure and practice in the elimination of defects in school children and in the solution of our crime problem must be established. With a survey of the schools of Chicago as a basis it is estimated that in the United States and Canada more than 15,000,000 children of school age are suffering the handicaps of correctable defects. In the correction of the physical and mental ills of children there will be found at least a partial solution of the seemingly insurmountable behavior problems of our youth.

A general appreciation of the higher standards set by the American College of Surgeons has made it possible for the legally constituted health departments to raise their minimum requirements. The International Society of Medical Health Officers has recently been organized, its objective being to raise the standards of public health administration and to co-operate closely with bodies of like ideals. I ask consideration by this Congress of the possibility of a workable affiliation between medical health officers and standardized hospitals through the International Society of Medical Health Officers.

MEDICAL AND SURGICAL ECONOMICS—INTRODUCTORY REMARKS

FRANKLIN H. MARTIN, M.D., Chicago: In arranging this symposium we have sought to bring together authorities who are interested in the economic solution of the cost of medical care—authorities who are in a position to know the facts involved and to estimate the bearing of these facts on the solution of this intricate problem.

The cost of medical care involves six fundamental factors: (1) the medical profession; (2) therapeutic measures; (3) the hospitals; (4) the laboratories; (5) the trained nurse; and (6) the demand of the public. A fair, judicious, thoughtful appraisal of these factors will be productive of competent evidence. The parts played by these various factors may be summed up as follows:

1. The average income of practitioners of scientific medicine is low compared to the income of other learned professions and is not to be considered as contributing heavily to what has been termed the high cost of medical care.

2. Legitimate therapies, as prescribed by scientific, legalized practitioners, are reasonable in cost. Self-prescribing may lead to unreasonable expense. Excessive expense is often incurred through the use of patent medicines and so-called therapy as applied by irregular practitioners.

3. The average cost of routine hospital care is not exorbitant, even in face of the fact that we are in an age of extravagance and reckless expenditure.

4. Laboratory charges, when limited to the generally accepted routine tests and to special tests actually prescribed by the legalized practitioners of regular medicine, are reasonable in comparison with scientific laboratory work in the commercial world.

5. The fees of professionally trained nurses are far below the salaries of skilled workmen. They

certainly cannot be accused of contributing to excessive cost of legitimate medical care.

6. The public demands not only legitimate medical care of the best quality but when slight or serious illness comes, people are often reckless in their demands for extravagant rooms, unnecessary nursing, and unwarranted consultations. These are often paid for by amounts in inverse ratio to their importance.

Sickness is an unlooked-for emergency, and its cost, at any price, is looked upon as an embarrassing burden.

MEDICAL AND SURGICAL ECONOMICS FROM THE STANDPOINT OF THE HOSPITAL ADMINISTRATOR

CHRISTOPHER G. PARNALL, M.D., Rochester, New York: Medical costs are only a part of the general advance in the present-day standards of living. They stand out prominently because they come to the average person when he is least able to bear their burden. Doctors, as a class, are not becoming unduly rich. Hospitals must struggle harder than ever to make up their deficits. Medical care becomes merely one of the multitude of factors in the high cost of modern living. The cost of preparation for medical practice has reached the point where one is appalled in considering it. It is getting so that only the well to do may contemplate medicine as a career. The doctor, as a consequence, must make a just charge for his work, but should refrain from ordering expensive service without duly considering its actual necessity. Despite the fact that hospitals are having a hard struggle to provide within their budgets for necessary and desirable activities, there is waste and unwarranted extravagance in the building and maintenance of some hospitals. Too often hospital building projects are undertaken in the spirit of excelling in physical form.

Probably the most feasible plan is a service organized and controlled by the hospital with limited professional fees or stated salaries for staff physicians. Unfortunately, a considerable proportion of persons of moderate means fails to discriminate between the essential services of the hospital and those which are relatively unimportant. The cost of medical care is high but, before there can be any large reduction of costs, some plan of co-operation which includes the doctor, the hospital, and the public will have to be worked out. The problem concerns not only the cost but also the *burden* of the cost. If the burden can be distributed the problem will be solved.

The Committee on the Cost of Medical Care, constituted as it is and enjoying the confidence generally of the public and medical profession, is perhaps the most logical group to which we may look for leadership. Simply stated, the task of its members is, is it not, to propose a feasible plan for the distribution of the burden of the cost of medical care? The accomplishment of that task will be a difficult and momentous achievement in which the medical profession will justly share.

MEDICAL AND SURGICAL ECONOMICS FROM THE STANDPOINT OF THE NURSE

JANET M. GEISTER, R.N., New York: The nursing needs of the patient in modest circumstances must be met at a price which the average patient is able and willing to pay. Inextricably bound up in the problem of economics are the questions of availability and quality; of a graded service meeting all types of nursing needs; and of a nurse reserve for epidemics, disasters, and other periods of unusual stress. To the nurse the question of economics includes not only the need for a reasonably adequate income but reasonable hours of work and opportunities for advancement, for further study, and for some family and social life.

It is being demonstrated daily through visiting and student nurse work that the majority of our patients can be made comfortable and secure with an intermittent service. Both visiting nurse and student demonstrate that with intermittent service the personal relationship between nurse and patient can be constructively maintained. The waste of the general practice of continuous nursing care cannot be overemphasized.

It seems inevitable that for the great group of patients of modest means our nursing resources must be organized. Practically, this means organizing graduate staffs on salary for both hospitals and home patients. This would not preclude the employment of special duty nurses for continuous service if the patient could afford it, nor would it keep from the critically ill patient the continuous service he must have. A continuation of present individualistic methods of nursing offers no hope for a reduction in nursing costs. The nurse must have a decent reward for her labors and when this reward goes below the minimum standard accepted by the community for other workers the end-result is jeopardy of the patient. The well qualified nurse is forced into other fields. The present annual income of the private duty nurse has reached the lowest level compatible with any degree of safety to patient, nurse, and community. We can offer to the patient a uniform quality of nursing, the amount based on his needs rather than on an arbitrary 24-hour day scheme, at a reasonable cost only if our present waste is eliminated and control and distribution are facilitated.

This means an organized graduate nurse staff which will offer to the nurse the things she should have—a reasonably adequate income, a shorter working day, opportunities for study and advancement, and constructive leadership. The present individualistic form of service provides no machinery for obtaining these things.

THE RELATIONSHIP OF MEDICINE AND ITS AIDS TO THE COST OF MEDICAL CARE

REV. ALPHONSE M. SCHWITALLA, S.J., Ph.D., St. Louis: The unique and privileged position of the physician in his dealings with his patient has been radically and, in all probability, permanently invaded. The nurse, the hospital authorities, the dietitian, the social worker, all have something to think and to say, independently of each other, concerning the welfare of the patient. The nurse is gaining in her progress toward professional autonomy. The dietitian is carrying on a crusade for a recognition of her position in dealing with the sick. The social worker, too, is suggesting that she has an independent contribution to make toward the study and care of disease. The laboratory worker has given more than a hint that his or her function is not merely to aid in diagnosis but actually to voice an opinion in therapeutics.

Obviously, the sick human being is an interesting object of study. Not only the physician's efforts but the efforts of all his assistants have made our people progressively health-conscious, and as a result of enormous propaganda there now exist countless health activities which 20 years ago either were unknown or, if known, were relatively insignificant. We are confronted with the fact that the sick man is surrounded by a swarm of officials and semi-officials, each, to be sure, fully capable of adding greatly to the comfort, peace of mind, and health of the patient, yet each fully conscious that he has a right to an adequate financial reward for the services which he renders—a reward, too, commensurate with increasing standards of education and experience. Is it any wonder, therefore, that an economic problem of enormous magnitude has arisen from our health activities?

If the costs of illness are to be decreased, one or more of four cost factors must necessarily be depressed, namely: (1) the hospital costs, (2) the physician's fees, (3) the nursing costs, and (4) the cost of accessories. The hospital has, I believe, successfully vindicated itself against the charge that it is a money-making and avaricious institution. We have numerous pronouncements from physicians in various parts of the country in which the charges for medical care are vindicated. As far as the nurses are concerned it may be granted, without fear of contradiction, that the present scale of prices for nursing service is, generally speaking, anything but exorbitant. And what about accessories? The incidental hospital expenses, such as the cost of medicines, operating rooms, fees for anæsthetics, laboratory work, and other extras, all combined represent, as closely as we may judge, one-fifth of the cost of illness. Even if we were to reduce these expenses by one-half we would have reduced the total cost of illness by not more than 10 per cent. Here then is our economic problem in so far as it relates to medicine: the hospital cannot reduce its charges; the physician must not be asked to do so; the nurse cannot do so; and the cost for accessories may be reduced at most by only 50 per cent. Clearly, we are confronted with a problem which is intertwined with our whole economic system, and, until the large and comprehensive study now in progress has been completed, any suggestion of a radical character would seem untimely.

NURSING AND HOSPITAL COSTS FOR INDIVIDUALS IN MODERATE CIRCUMSTANCES

WILLIAM J. MAYO, M.D., Rochester: There are two classes of patients to whom the expense of hospitalization presents no problem: the 15 per cent of the population at the upper end of the financial scale to whom the cost is an unimportant detail and the 15 per cent at the lower end of the financial scale who are essentially objects of charity. Of the intervening 70 per cent, 10 per cent toward the upper end, at some inconvenience, can continue to carry the financial burden and 10 per cent near the lower end cannot pay their doctors but can pay something toward hospital costs. The intervening group, comprising at least half the total population, finds the cost of hospitalization and nursing a burden which can be met, if at all, only by a very considerable sacrifice.

Supersalesmanship is sometimes found in the hospital. The patient is placed in surroundings which, however much they may appeal to his æsthetic sense, are above his means and have no value in relieving the condition from which he is suffering. The patient in a well planned ward which gives a moderate degree of privacy will make a quicker recovery, as a rule, than the patient in a private room with two attentive nurses.

State medicine has worked wonders in the prevention of disease. It has added 18 years to the average human life. However, for the state to take over the care of ordinary illness would introduce civil service mediocrity, more drugs,

more routine, and less scientific attention for the patient. There are schemes for governmental health and hospital insurance and it may be that eventually something of this sort will be evolved to aid in the solution of the problem. As a matter of fact, the hospital is a community asset, not a profitable business, and must be accepted as such.

Personally I believe the 2-year course of nursing as a minimum would have been better for the average nurse than the 3-year course. The routine 2-year course would not be relished by the hospital authorities, who profitably absorb much time and labor from the nurse in training. I would not establish an upper limit of nurses' training but would encourage all those who had the desire and ability to take 3 or 4 years of training, just as medical students are encouraged to take postgraduate work. The special work for nurses would fit them to fill superior positions.

Patients at the upper end of the financial scale, whose economic condition warrants it, will continue to have two nurses, 12-hour or 8-hour duty, or whatever they desire, the more the better. I shall be pleased to see the nurses get jobs. For the common man the hospital should employ the nurse and use her in superior positions and when necessary at an extra charge sufficient to cover the cost of semi-private care of several patients. Her fine training is wasted in scrubbing floors, making beds, giving patients baths, and doing many other tasks that a hospital maid could be trained to do in 6 months. The nurse has had superior training; she should have a superior position with reasonable hours and certain pay.

I believe the financial burden of sickness on the common man, so far as hospital and nursing care is concerned, could be greatly reduced by properly planning and equipping hospitals, by introducing economical methods of caring for the patients, and by compelling the proper authorities to pay for the care of those unable to meet the expense. The municipal or county authorities should not sponge off funds from the charitable-minded or add to the burden of the sick, already overtaxed.

COMPARISON OF MEDICAL AND HOSPITAL COSTS FOR INDIVIDUALS IN MODERATE CIRCUMSTANCES

STEWART R. ROBERTS, M.D., Atlanta: The patient in moderate circumstances is to the hospital a business proposition. When sick he must have service in proportion to his sickness, no matter what his means. It is the sickness and the cure that count with the wealthy patient, while it is the sickness, the cure, *and the cost* that count with the patient of moderate means.

It is difficult to state the relation between medical fees and hospital costs for patients in moderate circumstances. The problem involves many elements—the patient; his thrift; the length of his stay; the kind of room or bed he accepts; whether or not he has an operation, X-ray, or laboratory examination; whether or not a trained nurse is employed; and whether the physician charges his regular fee without relation to the circumstances of the patient, reduces his fee to fit the financial circumstances of the patient when he enters the hospital, or scales it still lower in consideration of the depleted means of the patient when he leaves the hospital. Another factor to be considered is whether the patient recovers and is able to work in order to pay his medical fee, or whether he dies and leaves a family without support. Generally speaking, in a short illness, the hospital fee is from one-third to two-thirds of the medical fee. In an illness of moderate length, say 2 weeks, the fees are approximately the same. In a long illness the hospital fee is much larger than the medical fee.

GENERAL SUMMARY, WITH SPECIAL REFERENCE TO THE INFLUENCE OF UNIVERSITY DIAGNOSTIC CLINICS AND THEIR BEARING ON THE FEES OF INDEPENDENT PRACTITIONERS

RICHARD R. SMITH, M.D., Grand Rapids: The increased cost of sickness is a heavy burden to people of moderate means, and workers in the field of health should endeavor to make this burden lighter. At the same time the practice of scientific medicine must go forward. The doctors want the public to receive the best possible hospital service at a cost commensurate with such service. The doctor emphasizes the professional and scientific side, and the patients the nursing and household comforts to which they are accustomed. Some want privacy and a special nurse which increases their bills enormously.

Regarding costs as a whole, the hospital should be economically run; the hospital authorities have the urgent responsibility of seeing that the cost to individual patients is justly distributed and that no patient pays for more than he actually receives, estimated on a sound, fair basis. Most hospitals are run economically but not sufficient emphasis is placed on essentials. A credit bureau in each hospital for the investigation of the patient's finances and a schedule of charges which seems just and reasonable are essential.

In the university clinic the doctor sees an endorsement of state medicine which eventually may prove to have serious effects upon private practice and upon the health of the public which the

doctor serves. In order to teach the students, the university medical school needs material and receives into its hospital those who are supposed to be unable to pay more than their hospital bills. These clinics have grown enormously until today many patients are admitted to the out-patient departments and hospitals who could pay small or moderate fees but who receive professional services for nothing, thus taking from the practitioner a considerable amount of income.

Discussion

BIRD S. COLER, New York: We must draw a line between public and private duty. The city, county, or municipality should pay in full for charity and welfare patients in all hospitals and not leave this work to private charity. From the standpoints of efficiency and economy, the standardization of hospital equipment, supplies, and procedures is of great importance at this time. Much money is needlessly spent on hospital equipment which might be saved if there were well established standards to guide the hospital management. Herein lies a big field of endeavor for this organization which is serving the hospital field so splendidly.

C. JEFF MILLER, M.D., New Orleans: One of the problems facing us today is the question of the charity patient. Why should the physician as an individual or as a member of the medical staff have to assume responsibility for the charity patient? This patient should have proper care at the expense of the public—a community responsibility not to be borne by the physician in his personal or individual capacity.

MALCOLM T. MACEACHERN, M.D., Chicago: I fully believe that hospitals generally are being efficiently administered and doing all possible to keep down costs for the patient of moderate means. Most hospitals do 12 to 20 per cent charity work and frequently without subsidy or special funds to pay for it. The liquidation of this liability may sometimes mean higher charges to paying patients. Every hospital doing charity work should have subsidy from the municipality, county, or state, or some special fund or endowment to pay for this work and prevent its being a burden on the regular budget.

In the planning of hospitals costly administration may be saved through small, easily cared for rooms or cubicles, with the service convenient to the patient. A wide range of accommodation suited to the varied financial means of the patient is most desirable. Flat rates for services, group nursing, and the standardization of equipment, supplies, and procedures, all tend to keep hospital charges within the limit of the patient of moderate means. In all our discussions and possible reform let us always keep the best interests of the patient in the foreground, lest we become callous, inhuman, or mercenary.

OFFICIAL REPORT ON HOSPITAL STANDARDIZATION FOR 1929; 12 YEARS IN RETROSPECT

MALCOLM T. MACEACHERN, M.D., Chicago: During the year over 3,600 general and special (excepting mental and tuberculosis) hospitals of 25 beds and over were on the survey list, of which 2,855 were considered for approval. These were grouped as follows: (a) 100 beds and over, 1,334; (b) 50 to 99 beds, 974; (c) 25 to 49 beds, 547. Of the total, 1,969 were awarded full or conditional approval, leaving 886 which were not approved. Certificates of approval have been awarded to 1,403 hospitals prior to October 1, 1929. This year 18 hospitals which have lost their rating of full approval will be requested to return their certificates for failure fully to comply with the requirements. The total bed capacity of the hospitals under survey is 409,359, of which 359,169 beds are in approved hospitals. This means that approximately 7,183,380 patients spent at least 82,200,560 days in approved institutions during the year.

Hospitals are classified as follows: (1) not approved—the hospital which does not accept or meet the requirements in any respect; (2) conditionally approved—the hospital which has accepted the requirements and is endeavoring to meet them, but for lack of time or other acceptable reasons has not been able to carry them out in full detail; (3) fully approved—the hospital which has met all the requirements and is carrying them out in an acceptable manner; (4) certified—the hospital which has been fully approved for sufficient time to assure the American College of Surgeons that it will conscientiously live up to the requirements at all times and has therefore been granted a certificate of approval.

The eight fundamental principles of Hospital Standardization are:

1. A modern physical plant free from hazards inimical to the patient's welfare and safety, properly furnished and equipped for the comfort and scientific care of the patient.

2. A carefully selected governing body representative of the best community interests, in which body is vested complete and supreme authority for the management of the institution.

3. A competent chief executive officer or superintendent with authority and responsibility to

carry out the policies of the institution as approved and authorized by the governing body.

4. An adequate and efficient personnel, competent in the various fields to carry out the details of management and administration under proper supervision, and responsible to the chief executive officer of the institution.

5. An organized medical staff of ethical, competent doctors to determine, develop, control, and carry out the professional policies of the hospital subject to approval of the governing body.

6. Adequate diagnostic and therapeutic facilities with efficient technical service, under competent medical supervision.

7. For all patients treated, accurate and complete case records, cross indexed and filed in an accessible manner so as to be available for future study, reference, and clinical research.

8. Group conferences of the administrative officers and medical staff to review regularly and thoroughly the activities of their respective divisions for the purpose of keeping the service and scientific work on the highest plane of efficiency.

Some of the outstanding results of Hospital Standardization are:

1. The shortening of the patient's stay, now generally ranging from 8 to 15 days, with an average of 12.5 days, a decided improvement over that of 10 or 12 years ago.

2. The lowering of hospital mortality rates to a range of 2 to 6 per cent, with an average of 3 to 3.5 per cent, a vast improvement over the percentages of 10 or 12 years ago.

3. The lessening of the incidence of infections, complications, and secondary conditions, as revealed by hospital records and statistics.

4. The increasing number of consultations, promoting better diagnoses and therapy.

5. The increasing number of autopsies, making the practice of medicine more thorough and accurate.

6. The group study of certain diseases, based on the clinical records of the hospital.

7. The increasing interest in teaching and clinical research manifested by the medical staff and hospital management.

8. The greater use by the medical staff of diagnostic facilities, such as the clinical laboratory and the X-ray, to assist in making or confirming diagnoses.

Discussion

N. P. Colwell, M.D., Chicago: In the past 50 years there have been more remarkable advances in medicine than in all previous time. There has never been a time when nations around the globe have been so free from epidemics as at present. Instrumental in advancing the practice of modern medicine have been the hospitals. With the rapid development of these institutions, it is not surprising that some have not gained all the equipment and other essentials for a good hospital. However, the different hospital agencies are all working for the same purpose—the best possible service to the sick and injured. We must all work together for this worthy cause. The splendid co-operation which has been shown since Dr. MacEachern has been in the work must be continued.

THE SUPERINTENDENT'S VIEWPOINT OF THE NURSING PROBLEM

Paul H. Fesler, Minneapolis: The present day nursing problem is: (1) to reduce and improve the supply of nurses; (2) to replace students with graduates; (3) to help hospitals meet the cost of graduate service; and (4) to get public support of nursing education. The Committee on the Grading of Nursing Schools is now studying questionnaires to ascertain actual conditions in the personnel of schools of nursing, to the end that the number of schools and possibly the number of students may be greatly reduced.

The American College of Surgeons after 10 years has reached a very small percentage of the smaller hospitals. More than 50 per cent of hospital beds are in towns of less than 10,000 and 61 per cent in towns of less than 25,000. In Minnesota practically every community has a modern hospital with modern equipment. However, it is difficult to get nurses to go into such communities, for a nurse trained in a large, modern hospital craves the continuous activity to which she is accustomed. It is not imperative that these small hospitals have nursing schools, but many have to conduct schools in order to have a nursing service.

The large hospital faces problems which have resulted from propaganda regarding the cost of medical care to the middle class—which cost usually begins and ends with the hospital bill—but all hospitals of any importance have good service for the middle class patient. Hospital costs are simply keeping up with the advance in medicine. This increased cost can definitely be divided into two parts: (1) service—primarily nursing service—and (2) education. The added expense is more than covered in the saving of time to the patient and in increased efficiency, since hospitals are instituting many time and labor saving devices. The patient now spends 10

or 12 days in the hospital, whereas he formerly stayed 25 or 30 days. The patient satisfied through an efficient nursing service is the best advertisement for a hospital, so it is imperative that the hospital maintain an interest in this service. The hospital should contribute something to education for, if good service is rendered, this will be reflected in a substantial way, bringing in money which can be spent for buildings and education alike. The patient should not pay for the education of nurses. Most of the large hospitals receive endowments or gifts, and by appealing for funds for education will undoubtedly obtain sufficient for their needs. Some of the best nursing schools, whose standards of admission have long since been raised, are in large private hospitals.

Some 12 o. 13 of the larger universities have organized the 5-year combined course in nursing, but only a small percentage of the students take the 5-year course. Only 1 university—Yale—does not give the 3-year course. Of the enrollment of 500 in the University of Minnesota, only about 85 are 5-year students, but they leave school with the same standing as any other nurse who passes the State Board examination. The university should contribute to the welfare of all the people of the state, even the patients in small hospitals. Such an end could be achieved in small hospitals by setting standards for their nursing schools which would have to be met before their graduates could affiliate with the larger hospital. Many small hospitals could not meet such standards and some would continue with unapproved schools, but if the university and larger hospitals would train public health nurses and send them into the remote districts they would have considerable influence on the smaller hospitals and, to some extent, relieve the situation. There is no question that in adjusting this matter the patient must be the first consideration, and the movement for better nursing schools will not succeed if it does not reach the rural districts.

HOW CAN WE ASSURE EFFICIENT NURSING CARE OF THE PATIENT?

E. Muriel McKee, R.N., Brantford, Ontario: In any hospital the careful selection of the nurse, a sufficient number of nurses, and adequate equipment and supplies are imperative to assure good nursing care of the patient. There is the hospital which does not maintain a school for nurses but employs graduate nurses to care for patients. If the hospital enjoys a good reputation, is well organized and equipped, and offers proper remuneration, it is not difficult to secure a good nursing service. In this day, however, the hospital affiliated with a university school of nursing is becoming more prominent and offers the following two distinct problems: (1) the care of the patient and (2) the education of the nurse. As the demand for hospital accommodation has increased new hospitals have been built and new wards and departments added to those already in existence. In many of the new hospitals, training schools for nurses have been established, while those already existing in the old hospitals have been greatly enlarged. The growth of a school for nurses should be determined by the quality and reputation of and demand for its graduates, rather than by the growth of the hospital. The careful choice of student nurses—selecting each one on her merits and qualifications and not because a definite number must be secured—is one of the surest means of obtaining efficient nursing service. Student nurses under proper supervision often cannot meet the demand because their service is continually interrupted. There are certain patients whose physical condition demands the skilled services of a graduate nurse, but the high cost of this type of service has resulted in a new service in hospitals which is proving very satisfactory, commonly called "group nursing," which means that the divided attention of graduate nurses is offered, the patient securing their service at much less than the cost of a full time "special" nurse.

There are certain very definite prerequisites to efficient and economical care of the patient, without which the most capable nursing staff is unsuccessful. One of the first considerations is the conservation of time and physical effort, and if every ward in the hospital were a complete unit—a special hospital, so to speak, for the type of patient it cares for—this could be realized. The employment in sufficient number of ward helpers and well trained orderlies to do the routine work is a sound economic measure. The present day careful planning of new hospitals and reconstruction of old ones also mean more efficient nursing care for the patient.

Sister Helen Jarrell, Chicago: "Efficient nursing care" is defined as aiding the patient physically, mentally, and spiritually or morally, the two latter—mental and spiritual assistance—occupying a cause-and-effect relationship to the former. Since this care is provided by the nurse, it is imperative that only the highest type of nurse be employed. The mental side of the nurse's education is covered by the curriculum, which should be supplemented by proper facilities and the right type of faculty. Physical education is promoted

by providing the proper facilities and by encouraging the student to take advantage of them.

If the hospital is sectarian, moral education can be obtained by religious training. In Catholic hospitals this is particularly easy for they can make a direct appeal to the students through the fundamental tenets of their religion. In hospitals of a non-religious type, the moral training must be attained by bringing the student to a proper realization of, and respect for, her work.

The best means of insuring efficient care for the patient is through the maintenance of a high grade nursing staff. And this, in turn, is insured only by the proper type of education in our schools: education which makes for well balanced graduates who regard their profession, not as a means of earning a livelihood, but rather as a sacred calling, and who, while caring for the physical, mental, and moral needs of the patient, find divine inspiration for their work in the words of the Master: "Whatsoever you do unto the least of these, my brethren, you do also unto Me."

Discussion

ADDA ELDREDGE, R.N., Madison: All state studies tend to prove the report of the Grading Committee correct. A small study in my state has proved the oversupply of nurses. The Grading Committee's report is based on the fact that there is an oversupply of nurses, very poorly distributed. It is undoubtedly true that many people are not properly nursed, even when many nurses have no work to do. Small hospitals are increasing in number and nurses must be provided for them. Graduate nurses will be glad to nurse in small hospitals if the working conditions are satisfactory. The superintendent of nurses must be as capable in the small hospital as the large. Often greater ability is required in the small hospital, for in the large hospital things are usually well organized. Proper living conditions, a graded salary, and a plan for staff education are necessary. In small institutions, so many graduate nurses would not be required if there were a carefully graded service with attendants or maids, under proper supervision, who were not permitted to render nursing care, which should be given by only the nurse herself.

In the general discussion which followed, several speakers commented on two important matters: (a) the discontinuance of the monthly allowance to student nurses and the diversion of the money to nursing education—a plan favored by many present; and (b) the obtaining of better qualified instructors in schools of nursing to avoid the frequent anomaly of the student nurse with a more extensive background of education than her teacher. A strong plea was made for higher educational standards and pedagogic proficiency in schools of nursing.

STAFF CONFERENCES

WALTER S. GOODALE, M.D., Buffalo: In recent years appreciation of the value of group thought and action has penetrated the practice of medicine. No one man or woman can know everything about medicine, which daily becomes a more complicated science and art. Therefore, conferences of various kinds have been introduced into hospital practice, thus making diagnoses and therapies more communal concerns than individual, as heretofore.

The minimum number of staff conferences for each hospital should be one a month but weekly meetings are better. The large hospital may hold a monthly general conference and more frequent departmental conferences, including the pathological. There cannot be too many conferences if they are all instructive. In the Buffalo City Hospital, we take particular interest in the internes' conference, 1:00 to 2:00 p. m. daily, for the discussion of all serious cases in the hospital. This is most valuable in our type of institution, not only from the standpoint of care of the patient but for the education of the interne. All staff conferences should aim at improving the service for the sick and injured and the education of the medical staff.

Discussion

JOHN T. BURRUS, M.D., High Point, North Carolina: We have a weekly staff conference which everyone must attend. Cases terminating in death are discussed. Every autopsy is fully discussed. Inquiries are made into any infections occurring in clean cases. All cases which are not doing well are discussed from every possible angle. We do not exempt from the staff conferences our nurses, laboratory technicians, anæsthetists, or instructors of nurses. I think the greatest and final test—the acid test—of any institution is the determination of the extent to which it can lower its death rate. If the records of an institution show a high death rate then there must be something wrong.

STAFF CONFERENCE DEMONSTRATION

The medical staff of Ravenswood Hospital, Chicago, some 15 in number, under the leadership of Dr. E. B. Williams, chairman, gave a most interesting and instructive demonstration on how to conduct the staff conference, beginning with the

presentation of four charts on lantern slides as follows:

Chart I, statistical analysis of work for month showing, among other features: mortality rate, 2.7 per cent; autopsies, 33.3 per cent; consultations, 7.8 per cent, somewhat lower than the average of 10 to 15 per cent, explained by the fact that consultations were not always recorded.

Chart II, graph showing percentage of autopsies for each month, an average of 43 per cent for the year.

Chart III, graph showing decreasing percentage of unfinished case records.

Chart IV, graph showing increasing use of library and bibliographies.

In the latter two slides it was readily apparent that with the increasing use of the library the number of unfinished records gradually decreased.

The remainder of the hour was spent in the presentation and discussion of 4 cases as follows:

Case 1. Presented by D. B. Pond, M.D. Subglenoid dislocation of shoulder with open reduction following failure to reduce by means of manipulation; sudden death occurred on ninth day after operation from embolus, as revealed by autopsy. This illustrated one type of case which should be discussed at the staff conference—an unexpected death.

Case 2. Presented by Clark A. Boswell, M.D. Acute cerebrospinal meningitis which made a most satisfactory recovery following serum therapy. This illustrated another type of case to be presented to the staff conference—a case showing a most satisfactory response to treatment.

Case 3. Presented by George W. Green, M.D. Traumatic hæmorrhagic pancreatitis with cholecystitis and cholelithiasis; death followed shortly after operation. This illustrated a third type of case suitable for presentation at the staff conference for review and analysis of diagnosis and procedure.

Case 4. Presented by George deTarnowsky, M.D. Chronic hæmorrhagic ulcerative colitis; recovered and patient was shown to medical staff. This illustrated a fourth type of case to bring to the staff conference—one showing intricacies of diagnosis and treatment and the advantages of group analysis.

Discussion was carried on by various members of the staff, including the pathologist and radiologist. The conference demonstrated: (1) a proper physical setting; (2) a full attendance of staff members; (3) starting and ending exactly on time; (4) discussions continuous, spontaneous, argumentative, to the point, and limited absolutely to actual work of the hospital; (5) the proper spirit—group constructive review and analysis of the clinical work, of educational value to all present.

THE ACCREDITING OF SURGICAL DEATHS

ERNEST LEROI HUNT, M.D., Worcester: From time to time thoughtful men have urged that we pause to count the cost of surgery in lives and morbidity and scrutinize our products with the same fair-mindedness with which a banker studies his investments or a manufacturer his output. These men include Codman of Boston, Poole of New York, Willis of Richmond, and Bernheim of Baltimore.

Vast betterment in working conditions for the surgeons and increased comfort and security for the patients have been achieved through the influence of the American College of Surgeons through its program for the standardization of hospitals. These things were accomplished by organized effort. Is it not time to turn attention upon the results of our own handiwork and apply to them another minimum standard which shall relate to our efficiency as craftsmen in the field of applied surgery, to establish a uniform standard method for auditing all surgical deaths, and to set up the system necessary for its proper functioning through some central body?

Because of its record of achievement, its vast influence upon public opinion, the confidence it merits in the wisdom of its leadership, and the fact that its work is our work and not something forced upon us by others, the American College of Surgeons is the agent best qualified to determine and promulgate such a standard. The organization to do this work already exists in part and the work proposed is quite in line with the purpose of the College and the existing requirements for Fellows and approved hospitals.

Discussion

JOHN DEJ. PEMBERTON, M.D., Rochester, Minnesota: Some hospitals have an ironclad rule which charges to surgery every patient who dies in the hospital after an operation, irrespective of the lapse of time or the cause of death. Naturally, in those instances where death occurs many weeks after the operation and is in no wise the result of the operation or the condition for which the operation was undertaken, a strict adherence to the surgical rule is grossly unfair.

Some years ago I wrote to about 15 of the representative hospitals of the country and learned that many of the larger and well managed hospitals had no accepted method of accrediting deaths, and also that there was a wide variation in the rules of those that had accepted methods. Since then the American College of Surgeons has made a nation-wide survey revealing a most chaotic state of the present method af accrediting deaths and the great need for standardization. A large majority of hospitals earnestly desires some uniform method of recording deaths after operations and I think it is only awaiting leadership. That leadership should come through an agency which rep-

resents all the hospitals and I believe that the American College of Surgeons should assume it.

HERNIA OPERATIONS AS AN INDEX OF HOSPITAL INFECTIONS

CHARLES N. COMBS, M.D., Terre Haute, Indiana: Dr. MacEachern not long ago specified the methods that hospitals generally employ in checking the efficiency of their sterilizing processes. This ideal plan covers too much territory to be practical, considering the hospital budget, and there are many operations commonly classified as clean where there are chances for auto-infection. An operation for hernia is primarily free from infection unless introduced by faulty technique. Admitting that elective hernia cases (which debar strangulated and incarcerated ones) are clean to start with, any infection subsequent to operation indicates a break in the aseptic chain. We still use the Diacks, the steam gauge pressure recordings, the constant supervision of the autoclaving, but we use as a control only the elective hernia operations and not the entire surgical output.

During the 2-year period of study we had 150 hernias of this exclusive class, or 3 per cent of the total number of operations. Not a single deep infection occurred, but there were 17 superficial infections, an incidence of 11 per cent. In the first half there were 13 of these infections, or 17 per cent, while in the last half there were only 4, or 5 per cent. To state baldly that we had 11 per cent of infections would be untrue. We have called "superficial infection" the occurrence of a seropurulent discharge on a dressing requiring more than one additional dressing. The average length of hospitalization after operation of the first half of the 150 cases was 14.1 days, of the remainder 13.8 days. When hernias, mine run, are discharged with dry wounds in 14 days there would seem to be a minimum of infection. Our study demonstrated the advisability of adopting a standardized preparation and the superiority of the "point" system of after-dressings. It showed also that a discriminating scrutiny of the progress of wound healing in selected hernia cases is an authoritative check on surgical asepsis.

Discussion

SOUTHGATE LEIGH, M.D., Norfolk, Virginia: I wish to endorse and emphasize the statements of Dr. Combs. The "instrumental" dressing of wounds is important as is also the careful removal and prompt destruction of all septic dressings. However, I am not entirely in accord with the stress he has placed upon auto-infection or infection from opening the digestive and other tracts. The former is so rare that it may be disregarded safely and the latter can usually be cared for by appropriate antiseptics and an exceedingly careful toilet. I cannot let pass this opportunity to stress the vital importance of strict attention to every detail of surgical cleanliness. Infection is the bane of modern surgery. The weakest point about the large hospital today is the lack of strict operating room control. Operating rooms must be kept clean; ungowned persons must be kept out, and septic discharges caught and promptly destroyed. Frequently gloves are incompletely sterilized. Unless thoroughly steamed, gloves should not be used indiscriminately in clean and dirty cases, and, in addition to the partial heat treatment, they should be soaked, after putting them on the hands, in a very strong antiseptic solution, such as bichloride 1:250, a weaker solution following. Infection of clean wounds is due to carelessness or ignorance. This is a vital subject and deserves most serious consideration.

HOW CAN WE DETERMINE THE EFFICIENCY OF THE SURGICAL MASK?

IRVING J. WALKER, M.D., Boston (see page 266).

HOW CAN WE INSURE THE STERILITY OF CATGUT?

FRANK L. MELENEY, M.D., New York (see page 271).

PLUMBING IN HOSPITALS AS A SOURCE OF INFECTION—PROPOSED SAFEGUARDS

ARNOLD H. KEGEL, M.D., Chicago: The fact that faulty water supply systems are a means by which water may be polluted after it has been rendered sterile is recognized. The faults in the system most likely to cause pollution of the water are dangerous cross-connections. These cross-connections permit, at various intervals, water known to be teeming with pathogenic bacteria to contaminate sterile water supplies, thus making it possible to complete the cycle from the source of sepsis to the wound. The cycle producing epidemics of infected wounds in hospitals is readily established by tracing the course of the pathogenic bacteria from an infected wound into an instrument or utensil sterilizer, thence by siphonage into the clean water supply, back into the operating room in the supposedly sterile water, and thence into the clean wound. The main points upon which sanitary engineers and hospital consultants should concentrate are the following conditions, which have been found prevalent in the hospitals studied:

1. Faulty inlets on water supply connections to hot and cold water sterilizers, permitting leakage of contaminated water into them.

2. Drains or blow-off pipes on water sterilizers connected to waste pipes through which contamination may be sucked by the vacuum resulting from condensation of steam during cooling.

3. Instrument and utensil sterilizers having bottom connections, through which infected water may siphon back into the water supply system.

4. Steam condensers on sterilizers directly connected to waste pipes which permit siphoning action.

5. Therapeutic bathtubs and all other tubs having a bell supply.

6. Directly connected bed pan washers, slop sinks, and water closets from which siphonage may take place during stoppage of waste pipes or traps.

7. Kitchen and laundry washing machines having submerged inlets.

8. Sewer connections for filters, condenser coils of refrigerating machines, and cooling coils on sterilizers not properly safeguarded.

9. Check and waste connections where water supply pipes drain into waste pipes to prevent freezing in exposed locations.

10. By-passes around sterilizers for the purpose of maintaining a continuous supply of water even though the sterilizer is shut down.

11. Cross-connections with an impure auxiliary water supply provided for fire protection.

12. Suction apparatus connected to water pipes.

ORGANIZING FOR EMERGENCIES

CHARLES F. NEERGAARD, New York: In a hospital where centralized control appeared to be based on a general distrust of the personnel—a situation which resulted from several unfortunate experiences—a resident, with the collaboration of several other surgeons and two hospital directors, has worked out some suggestions as to organization. In this hospital, it must be remembered, it was not so much the lack of equipment and supplies which was at fault but the lack of availability, whether the need was for a simple laboratory test at night or assistance in the emergency department. It appeared to be more important to prevent theft of supplies than to insure prompt care in emergencies. The suggestions made for the emergency department are as follows:

1. For each emergency call, two nurses or a nurse and an orderly, shall report to the department to assist the physician. If not needed they may be dismissed. As a further safeguard, a signal system shall be provided to summon help.

2. In order that all equipment and supplies may be located quickly a complete list indicating the cabinet and shelf where each item is stored, shall be posted in a conspicuous place.

3. The location of apparatus which may be needed but which is kept outside the department shall be stated, also, where the keys are kept.

4. Any appliances with which the average physician may not be familiar shall have clear instructions for their use attached.

5. A properly typed list of donors, if possible from among the personnel of the hospital, shall be available for blood transfusions.

THE HEALTH INVENTORIUM IN THE STANDARDIZED HOSPITAL

FRANKLIN H. MARTIN, M.D., Chicago: Every intelligent individual now realizes the importance of submitting himself to a health audit at least once a year. This procedure has been advocated by many health societies; it has been preached from lay platforms and church pulpits; it has been recommended by authors of health columns; and it has been most earnestly advised by the family doctor. The majority of people, in considering the periodic health examination, naturally turn to this same family doctor for this service. Most people know that clinics and hospital services have been developed that give special consideration to the conduct of periodic health examinations which involve the use of elaborate laboratory facilities and other apparatus requiring trained technical aids for their application. Thousands of highly educated physicians realize that in order to make a comprehensive examination and record certain definite findings they should have access to facilities that are available to their more fortunate brethren through clinics or hospitals. How many practitioners could, unaided, make a complete physical examination of a patient, even though they had at their disposal all the laboratory and other diagnostic facilities? How many distinguished internists, surgeons, or other specialists would attempt such an examination without the assistance of a number of expert technicians, and occasionally one or more confrères in other specialties?

The plan called the "health inventorium" virtually provides a means of establishing in every community diagnostic clinics which would be available to all scientific physicians. The plan which the College submitted to the hospitals on its Approved List requested these hospitals to

extend the courtesy of their institutions to the qualified independent physicians of their community, and thus enable them to make necessary diagnostic studies in the conduct of periodic health examinations of their patients. This plan would not only provide to physicians an invaluable service but would enable the people of the community to receive the privileges of a diagnostic clinic under the supervision of their own physicians and in the environment of their own homes.

The hospital should furnish an examining room to which any legalized practitioner (who is a member in good standing of the American Medical Association and his county medical society, of the Canadian Medical Association and one of its subsidiary branches, or of similar medical organizations in the South and Central American Republics) may bring a patient for examination. The hospital should furnish to the practitioner such facilities in the way of aids, consultants, laboratory tests, etc., as will insure a comprehensive audit of his patient's condition. The charge for the required laboratory tests should be nominal and the maximum should not exceed actual cost. There should be no charge for the use of the examining room. The physician should render to the patient a bill covering his fee for examination, and where there is a charge for laboratory services he should be responsible to the hospital for its payment.

No hospital should accord these facilities to any individual who is not accompanied by his doctor or who does not carry a letter from his doctor in which certain services are requested. An individual who applies for examination and has no physician should be referred to a duly appointed, disinterested committee for advice in the selection of a physician. Each hospital volunteering to establish such facilities will be accredited as conducting a health inventorium.

Discussion

E. S. GILMORE, LL.D., Chicago: The field of the hospital has extended greatly in the last few years; we now feel we want to do all we can for the community. As evidence of that we have our social service department. This spirit is growing in the hospital and as a development of it we have the health inventorium idea. Diagnosis today is totally different from what it was a few years ago. The patient receives service from the laboratory, X-ray, physical therapy, and other diagnostic and therapeutic departments. No man, no matter who he may be, can do it all. Then there should be taken into consideration the large number of friends that could be gained for the hospitals and the amount of good our hospitals could do that they are not now doing.

General discussion followed. Reference was made to the desirability of all hospitals maintaining the good will of the community by doing all possible to promote not only curative but also preventive medicine. In the latter the health inventorium is an important factor. Hospitals must take into consideration not only the one-tenth of the people in the community who will be ill enough during the year to require hospital care, but render service to the nine-tenths who are not ill or, if so, are not aware of it. There are two sides to the question—the public and the professional. Physiology, anatomy, and normal functions of the human body are being taught in the early years of medical school and forgotten in the final years. Too frequently the doctor assumes that the individual would not come for examination unless something were very much amiss. Medical men must prepare themselves with renewed knowledge and a changed attitude to meet the requirements of this great movement.

The health inventorium can be developed in any hospital. There may be a little room downstairs which can be utilized; an elaborate department is not essential. It was suggested that the American College of Surgeons furnish a uniform blank for the record of examination. This has already been done by the American Medical Association.

The general practitioner is the one who will ultimately make the annual physical examination; the specialist cannot make it. For this reason it was suggested that apparently well persons should be sent to the doctor for examination, allowing the hospital to offer the laboratory, X-ray, or other diagnostic facilities. In New York the State Medical Association has recommended that the people go to their family physicians for examination, except those unable to pay for it, who should go to the hospital.

THE HOSPITAL TRUSTEE'S RESPONSIBILITY IN THE CARE OF THE PATIENT—HOW CAN THE HOSPITAL TRUSTEE KNOW WHEN THE PATIENT IS RECEIVING EFFICIENT HOSPITAL AND MEDICAL SERVICE?

LOUIS J. MCKENNEY, Highland Park, Michigan: A hospital trustee should be willing to give much time, thought, and effort to the hospital; he should take an active part in determining its policies and in its actual management. A small board, each member actively interested and having individual responsibility, can procure better care for the patient than a large board not

active as a whole. Responsibility with regard to housekeeping, finance, purchasing, nurses' training school, and maintenance are assumed by individual members of the board, co-operating with members of the hospital staff to whom these duties are assigned. Final authority on major questions is not given to the individual trustee but is vested in the entire board, which generally carries out the recommendations of the individual trustee. The board of trustees should see that the superintendent employed by them is one of ability and high standing in his profession so that the trustees can with confidence accept suggestions from him in establishing the policies of the hospital. Policies once adopted should be enforced by the superintendent through his personnel. Trustees should not interfere with the personnel except through the superintendent's office. The work of the hospital should be judged by: (1) its reputation in the community (established by satisfied or dissatisfied patients); and (2) an analysis of the case histories by an executive committee of the staff. The adoption of the standardization program of the American College of Surgeons will serve as a great help to any board of trustees in increasing the efficiency of the service. The board should in return demand from every member of the staff the most sincere effort and co-operation.

Discussion

JOHN D. SPELMAN, M.D., Pittsburgh: The solution of this problem can be found in the form of the terse dictum, "Know thy hospital." The first and most important factor is the general hospital policy as reflected by the ideas and ideals of its motivation; then the application and motivation by the directing head to whom is entrusted the duty of carrying out the hospital's policy. To these should be added the degree of resource that is placed at the disposal of the directing head in terms of personnel competent to contribute a creative performance and, last but not least, the resources of the medical staff and the degree of organization accomplished to insure medical teamwork.

If the trustee wishes to think of his institution in terms more idealistic than those applicable to a medical boarding house, he must assure himself that his hospital adequately carries out four cardinal functions: (1) that it has and is utilizing the most advanced armamentaria for treatment and diagnosis; (2) that the hospital's experience with disease is being properly recorded, the usefulness of correct scientific data proved, and incorrect data discarded (this constitutes the hospital's contribution to the sum total of medical knowledge); (3) that the facilities and experience with disease are being utilized in the training and developing of hospital personnel; and (4) that the hospital is contributing its fair share to preventive medicine.

NEWTON E. DAVIS, Chicago: The board of trustees is legally responsible for the patients in the hospital; the superintendent is not. The superintendent is simply an officer of the board of trustees to see that the latter act in conformity with the civil laws, the national and state laws, to see that the patient is given a fair deal, good diagnosis, and good treatment. The trustee will never know when the patient is receiving efficient hospital and medical service until every state in the Union is made responsible for the legal practice of surgeons in hospitals. The time is coming when the board of trustees will require assistance from the state to make it impossible for a man who does not know the technique of surgery to practice on any patient in any hospital anywhere, as well as in his office. The trustees do have responsibilities. They must carry on in a way that will create confidence, not alone in the mind of the individual but in the minds of the community and of all who have anything to do with the practice of modern surgery and hospitals.

In the general discussion which followed emphasis was laid on four very important factors bearing on the subject: (1) the governing body or board of trustees should select a hospital executive, competent to take charge of all departments, who should have adequate administrative and technical assistance efficiently to carry out the policies of the institution; (2) the individual members of the governing body or board should not concern themselves with the details of management of the hospital; (3) the governing body or board should have some comprehensive means of knowing when the patient is receiving efficient hospital and medical service; (4) the general consensus of opinion and the decisions of the Supreme Courts of the United States and Canada hold the governing body or board of trustees legally responsible unless it can be clearly shown that it has exercised due diligence and care in its selection of agents and employees.

WHAT FACTORS ENTER INTO AN EFFICIENT OPERATING ROOM SERVICE?

A. C. GALBRAITH, Toronto: The operative suite is generally located on the upper floor in order to secure the quietest, brightest, and most cleanly location available. The average suite includes anæsthetic rooms, sterilizing room, work

room, surgeons' dressing and locker room, and nurses' dressing and locker room, but only the exceptional layout provides for a quick section room, consultation room, dark room, supervisor's office, instrument and equipment room, soiled linen room, and cleaners' closets. All service rooms must be accessible and adequate for their purpose. The suite should be constructed and equipped with an eye to asepsis; unnecessary projections and ledges should be omitted. Skylights furnish a cleaning problem. Floors, walls, and furniture should not be porous, rough, or irregular, and should be of material and construction to permit of constant cleaning. With mechanical ventilation and heatless lighting units the provision of enormous window and skylight areas for the operating rooms seems to be no longer necessary. Efficient and comparatively inexpensive units of "shadowless" operating room lights are most approved by the surgeon. One or two spot-lights seem to be almost indispensable, and a secondary or emergency lighting system is absolutely necessary. A carefully regulated temperature is essential, while mechanical ventilation and electric fans are desirable.

A sufficient supply of instruments should be available for each unit so that one set may be sterilized and set up while the other one is in use. Intravenous and hypodermic injection outfits should be available for instant use. An approved suction apparatus is a standard equipment item. Records must be complete and continuous. The consent slip previous to operation and the anæsthetist's and surgeon's records immediately after operation are important. Skilled nursing and interne services are required. There is no place where co-operation is more essential than in the operating room.

Discussion

MAJOR G. SEELIG, M.D., St. Louis: The most certain way to assure ourselves of the safety of all operating rooms lies in the direction of stressing the fundamentals underlying hospital management and human relationships, rather than in prescribing specific procedures and methods. If we fully realize the facts—that the operating room service of a hospital is the one over which the angel of death most audibly and most constantly flaps his wings; that here, therefore, all regulations must be most thoughtfully formulated and most zealously executed; that such formulation and execution are primarily the duty of the surgical expert; and that however weak and human this expert may be in the flesh he always must be willing in spirit to recognize the principle of co-ordination—if we keep these facts constantly in mind, then the task of creating an operating room service, efficient in every detail, becomes simple beyond words.

THE X-RAY DEPARTMENT IN HOSPITAL MANAGEMENT

JOHN E. DAUGHERTY, M.D., Brooklyn: A study has recently been completed with regard to the practice in 24 representative hospitals in the organization and administration of the X-ray department and from this study the following recommendations are made: (1) the X-ray department should be centralized; (2) the director should be relieved of business management; (3) the medical responsibility should be chargeable solely to the director; (4) the facilities of this department should be developed along the lines of diagnosis, therapy, consultation, and teaching; (5) the director should be selected to insure development of the department along the lines indicated; (6) the director should be sufficiently compensated to insure freedom from pecuniary worries and in a manner to insure continuation of professional contacts; and (7) the fees should be arranged to encourage large utilization of this special department, serious consideration being given to a flat fee as a basis for all hospital charges.

Discussion

EDWARD S. BLAINE, M.D., Chicago: The X-ray department has three responsibilities:

1. To the patient. The department should give every individual requiring its aid a maximum of help.

2. To the patient's physician. If the service rendered is not a maximum one both the patient and the physician are literally short-changed.

3. To the hospital. This is reflected in the reputation built up for thorough work in the care of the sick.

The department head should have for his major function the accurate interpretation of X-ray findings. All management, in so far as possible, should be left to the executive office of the hospital.

Whether or not a hospital can afford to pay for the full earning power of a competent roentgenologist depends upon the size of the hospital and its potential income. It is practical and economically proper to have several hospitals in a neighborhood buy the services of one competent roentgenologist so that his total income will be satisfactory to him. The income from the X-ray department might roughly be divided into three parts—one-third going to the roentgenologist for his work, one-third to the hospital, and

one-third to be divided among the cost of materials, the salaries of others than the director, and a depreciation fund. No department should operate at a loss. From an economic basis it might be well if, in X-ray work, we had one charge for examinations limited to a single part, and another fee for complicated examinations.

WHAT IS BEING DONE TO ASSIST THE PERSON OF MODERATE MEANS IN SECURING ADEQUATE AND EFFICIENT HOSPITAL AND MEDICAL SERVICE?

MICHAEL DAVIS, PH.D., Chicago: The practical things the hospital can do for the patient of moderate means have been divided into two kinds: (1) changes in the physical plan; and (2) administrative adjustments. Of 467 hospitals that reported in a recent survey as to the proportion of single rooms, private rooms, semi-private rooms (with 2, 3, or 4 patients in them), and small wards (of less than 10 beds) as distinguished from large wards, this rather interesting situation was found. There were altogether about 100,000 beds. Outside the large wards these hospitals had nearly 60,000 beds in wards of less than 10 beds, in small rooms, and in single rooms. In the single rooms there were 27,000 beds; in semi-private rooms, 16,500 beds; and in wards of less than 10 beds, 17,000 beds. The largest single group of accommodations available to persons of moderate means outside the large ward is the single room—the highest priced type of accommodation.

Some facts were gathered from architects who are specialists in hospital designing. In 1908 the hospitals designed by some dozen architects had 28 per cent of their beds in large wards. A larger number of architects reported an average for 1928 of only 7 per cent of the beds in large wards. In other words, the designing of new hospitals exhibited a very marked trend away from the large wards in the direction of the single room, the semi-private room, and the small ward. The trend in the direction of smaller wards and single rooms is not in the direction of reducing hospital costs, although it clearly meets the demand of the public as to luxury in hospital accommodation.

From the point of view of administration the changes are: (1) the development of the admission system in such a way as to adjust the rate to the patient's ability to pay; and (2) adoption of flat rates for maternity and certain other cases. Only a small proportion of the hospitals replying to the questionnaire reported any particularly significant developments. They all manifested keen interest in the subject; they are wide awake but find it difficult to do much about it.

It seems to me that this study shows us that the public must not be misled regarding the possibilities of taking a big slice off the cost of medical service. The public, after all, demands service. To get that service it must be paid for. Dealing with the patient's bill through prevention and the distribution of the financial burden by some scheme of installments or insurance offers the most hopeful outlook for a solution of this problem. Surely it is desirable to proceed along the lines of adjustment of physical planning and adjustment of rates. Surely it is desirable to obtain more data, since one of the facts made obvious is the lack of real information on hospital costs, particularly for each special type of accommodation. Adverse criticism by the public is due to its ignorance of the facts. The hospital, furthermore, must deal with the existing financial structure and not attempt to impose a method for the payment of hospital and doctors' bills by demanding a sudden payment in an emergency situation in a community that is already accustomed to distributing the burden over a period of time.

Discussion

HERMAN L. FRITSCHEL, Milwaukee: A few years ago the Bureau of Labor Statistics of the United States Government made a study among 12,000 wage earners' families and found that the average medical expense was a little over $80 per family per year. I have made a study of the first 100 cases admitted to the Milwaukee Hospital in 1929. The average cost of hospitalization per patient during his time of sickness was $44.64 in the wards, $88.80 in private rooms, and $84 in the maternity department. Hospitals are providing for those of moderate means as follows:

1. Nearly every hospital has a number of beds for which it charges less than per capita cost.

2. Many hospitals have clinics and dispensaries where assistance is rendered gratuitously or at a nominal fee.

3. Hospitals maintain social service departments rendering services free of charge or at small expense.

4. Hospitals have endowments enabling them to furnish service at a more moderate price than would be possible if the actual cost had to be charged.

5. Hospitals are built by money raised for their erection and equipment and the capital invested is at the service of those of moderate means without any interest for investment being charged.

6. Hospitals as a rule allow patients of moderate means to pay their hospital bills in installments.

7. Hospitals have organized staffs which are ever ready to consider the financial condition of the patient and reduce their charges accordingly.

W. P. MORRILL, M.D., Portland, Maine: The high cost of getting well would be reduced if: (1) surgeons, instead of all demanding the same operating hours, would spread their operating hours over the forenoon, thus permitting a 50 per cent reduction in the number of operating rooms and the saving of thousands of dollars in construction, equipment, and personnel; (2) surgeons would depend less upon mechanical aids, reducing the demands upon the hospital laboratories; (3) surgeons who are familiar with the financial status of their patients would take it into consideration in making arrangements for them to enter, encouraging them to be content with less expensive quarters; (4) surgeons would keep the records they are pledged to keep, thus saving the hospitals large amounts of money in expensive dictaphone equipment, specially trained stenographers, and follow-up systems to secure the completion of records; and (5) surgeons would cease to order special nurses for patients who want only a glorified lady's maid. Verily, it is not the high cost of living but the cost of high living that confronts us.

ASA S. BACON, Chicago: Since the World War the value of money has decreased and hospitals, like other institutions, have to pay increased salaries to employees and higher prices for all commodities. Following is a comparison of the cost of hospitalization in 1904 and 1905 with that in 1928, considering in each instance similar cases, which is based on data from the ledgers of the Presbyterian Hospital, Chicago:

Operation	Year	Rate per diem	No. of days in hospital	Total cost including extras*
Appendectomy	1905	$1.75	22	$38.50
	1928	4.00	10	54.00
Cholecystectomy	1904	3.00	38	217.23
	1928	7.00	20	164.00
Diabetes mellitus	1904	2.00	45	90.00
	1928	5.00	13	72.75
Prostatectomy	1904	1.25	204	255.00
	1928	5.00	41	336.00

*Operating room, laboratory, X-ray, special nurse, etc.

It is interesting to note that obstetrical patients in 1904 stayed, on the average, 21 days, whereas in 1928 the average stay was 10 to 12 days. In 1904 and 1905 no extras, such as operating room charges, X-ray pictures, laboratory tests, electrocardiograph tests, metabolism tests, and other tests which aid the physician in making quick diagnoses, were included in the patients' accounts, while in 1928 each of the patients had one or more of these charges to pay. The rate for the rooms and ward beds in 1928 was rather more than double the rate in 1904. However, the advantage in 1928 of the great cut—more than 100 per cent—in the length of stay, allowing the patient to resume his occupation much sooner, is very evident.

THE RÔLE OF THE RECORD LIBRARIAN IN MAINTAINING AN EFFICIENT RECORD SYSTEM

FLORENCE G. BABCOCK, Ann Arbor: Expansion and vision must be the watchwords of the hospital record librarian, for as an educational assistant she is an active factor. There is the interne to be trained in history taking or the routine of writing records, the importance of which cannot be overestimated. The record librarian must be ever watchful to see that the proper information goes into the records. Their contents should be held in the strictest confidence by everyone who has access to them.

The record librarian also has another rôle, which relates to finances, if she has clinic clerks under her supervision whose responsibility it is to see that pay cases reach the proper desk for the payment of fees. She must be familiar with the policies and rulings of the hospital for she is the principal source of information concerning them. She must ever be on the alert to improve her department. A person of pleasing, happy personality is much to be desired. She must have the unfailing support of her record committee for in them is the bulwark of her strength. However, paradoxical as it may seem, she must be a power sufficient unto herself, for many times she will be called upon to muster forth all of her reserve forces.

Discussion

C. W. MUNGER, M.D., Valhalla, New York: Great emphasis should be placed on the librarian's work with the internes. The record librarian should assume the full responsibility that goes with the position. At the Grasslands Hospital small mimeographed slips are attached to deficient records, each with specific headings showing what is incomplete and the part of the chart in which it is—quite a time saving procedure for the doctor. To promote record work in hospitals printed professional standing orders should be issued containing very explicit directions regarding records. The record librarian should attend staff meetings and conferences, all medical meetings, and internes' meetings.

MAINTAINING EFFICIENT CASE RECORDS IN AN OPEN HOSPITAL

MARJORIE BOULTON, St. Louis: The Jewish Hospital of St. Louis has adopted the following

method of maintaining efficient case records: Upon admission of the patient, the admitting officer records the following data: patient's name and address; the hour and date of admission; age, marital state, nationality, and occupation of the patient; name and address of his nearest relative; and name of attending physician. Also any records of previous admittances are made a part of the patient's new record. The resident physician is then notified. After a preliminary examination he assigns the patient to the service to which he belongs, calls the attending physician, receives orders, and transfers them to the interne in charge of the service. The interne notes the present condition of the patient and writes orders for the nurses.

A complete history, with physical and routine laboratory examinations, must be recorded within 24 hours after patient's admission. Operative and anæsthetic notes are recorded within 24 hours after operation. Postoperative notes must be written daily on all surgical cases until the patient is considered convalescent and out of danger, then progress notes are written less frequently. No history is filed away without a final note from the attending physician as to his findings and diagnosis. Upon discharge a brief résumé is made by the interne, stating the patient's condition and his diagnosis. Charts for each service are inspected 3 times a week by the record librarian, who makes a notation of any missing data and calls it to the attention of the resident physician. After the patient is discharged and the chart is sent to the record room it is inspected for any possible missing data. Through the medium of the bulletin board, incomplete charts are called to the attention of the doctor responsible.

Record meetings of the medical staff are held weekly, at which time the records are reviewed and discussed. When the record is completed the name card is attached to the history bearing the hour and date of discharge, condition upon discharge, and final diagnosis. The record librarian co-operates with the physicians in their research work by collecting adequate material, compiling it in a convenient form, and placing it in the regulation history binder. Out-of-town physicians, or those not connected with the regular hospital staff, who refer patients to the hospital wards for treatment are mailed a statement of the staff physician's findings, diagnosis, and treatment instituted, with suggestions as to continuance.

Discussion

DONALD C. SMELZER, M.D., St. Paul: A few years ago it was a known fact that the open staff hospital had poorer records than the closed staff hospital, which is easily understood on analyzing the situation. The importance of obtaining complete histories is inestimable, and if the hospital starts its internes right and keeps close check on the staff—whether open or closed—there should be no difficulty in having first class records in any hospital. The record room should be located where closest contact with the medical staff will be afforded. Hospitals depend to a great extent on the interne for case records. Medical schools should more adequately educate internes along the lines of taking good histories.

THE VALUE OF ACCURATE RECORDS FOR THE STUDY OF CANCER

MAUD SLYE, PH.D., Chicago: The value of accurate records in the study of cancer cannot be overestimated. Records from which can be obtained the history of heredity will be of untold value to the research worker in evaluating experimental data. All research is started with a fairly limited specific goal, but probably no problem, however single, was ever thoroughly studied, whose attempted solution did not disclose numberless allied questions, since relations in nature are intricate and universal. Thus the solution of the most closely limited problem opens the way to new solutions and new light. The whole accumulation of science is built upon this fact. It would not be possible, I think, to take complete, accurate records for a long period of time upon any matter whatever without converting them into science and collecting returns unsuspected when the records were started.

Records have been disesteemed; the taking of them has been considered a red-tape bore and has been turned over to somebody—perhaps to the least important person concerned in the case. What we have wanted always is to cure, and the history of medicine is mainly a history of therapy and of therapeutic surgical procedures. We must see that we can never really "cure" until the causative factors are known. Then we can hope not only to cure but also to prevent. The way of finding the causative factors through records is slow, painstaking, monotonous, and fatiguing, requiring an intelligence never asleep, however irksome its occupation. Records must seek to penetrate and find the crucial points in the history of every case, and no record can ever report a past history as negative. It will seek to find the elusive positive. When hundreds of repetitions of these elusive positives stand out in the study of any given group of neoplasms, they will cease to be elusive and must declare them-

selves. If we can make our records sufficiently penetrating, if we will be patiently and consistently scientific in taking them, the external provocative factors in each type of neoplastic growth may be found. They will never be found from negative histories. They cannot, in many cases, be found from laboratory animals whose habits of living are unlike those of humanity and exclude many of the possible provocative factors commonly present in human living. It is time we accepted these penetrating human heredity records so that the part which heredity may play in the causation of human cancers need no longer be a matter of opinion but may be scientifically established or scientifically disestablished.

Discussion

BOWMAN C. CROWELL, M.D., Chicago: Without proper histories knowledge of cancer will not advance. At present complete histories on cancer do not exist; that is the reason we are not making more progress in our knowledge of cancer. Aside from the research work being done in various laboratories, the establishing of the Committee on the Archives of Malignant Diseases by the American College of Surgeons is a means by which we hope that records throughout the country may be improved. As an organization we seek the cooperation of record librarians, visiting nurses, and social workers, particularly the latter two who follow up the patient after treatment. The follow-up is most important in these cases and, as you know, the record has just begun when the patient leaves the hospital. The fact that the patient has been in the hospital, has had a thorough examination, with all this data accurately compiled in an acceptable record, qualifies the case for being recorded in our archives. Any hospital contributing to this work in the manner above described will be rendering a real service to science which ultimately, of course, must redound to the benefit of humanity.

THE CORRELATION OF THE RECORD DEPARTMENT AND MEDICAL LIBRARY IN THE HOSPITAL

STELLA FORD WALKER, Chicago: A combined record department and medical library with proper provision for research assistance results in more complete records and more interesting and profitable staff meetings. Series of cases in the hospital or a single unusual case may be made the subject of study, associated with a review of the literature in point. An active library will be called on continually in connection with the work in the hospital, furnishing information to the laboratory on occasion or to the doctor in the diagnosis or treatment of unusual cases, encouraging the study of internes, and serving in many other practical ways every day. Because of this close association of the work there is an advantage in having the library and record room combined or closely associated. The medical librarian and record librarian training should be associated. So much of the training is common to both and it is an advantage to either group to know the field and the possibilities in the work of the other group. The College Library affords a training center for such librarians, where intensive training in the fundamentals in the College Library and Research Department is offered.

Discussion

MARGUERITE SIMMONS, Chicago, and MAURINE WILSON, Chicago: About a year and a half ago the Ravenswood Hospital combined its library and record departments. The bi-weekly staff conferences are held in the library-record room, and at these conferences many records are completed and requests for library service received. It has been noted that as the requests for material in the medical library have increased in number, case records have been increasingly used for study, thus decreasing the number of incomplete charts reaching the record room. These hospital records are readily available, facilitating consultations and the compilation of statistics on groups of cases.

DAVID C. HILTON, M.D., Lincoln, Nebraska: The surgical section of the Bryan Memorial Hospital is responsible for one staff program annually. The basis is a study of a definite surgical problem based on compilation and analysis of case records on file in the hospital. This study is arranged as a monograph, with a convenient index and list of references, for practical use by members of the staff to aid them in their clinical problems and to lay a foundation for future studies of the same problem. These studies are mimeographed or printed in sufficient quantity for general distribution to the staff. The first study was on toxic goiter; in perhaps 10 years this same subject will be reviewed from the hospital records. Arrangement of the program, which is the same in all studies, is as follows: (1) the title; (2) an index; (3) a digest in outline of the surgical problem, with a list of references; (4) the kernel of the report; and (5) appendices. The greatest problem before the compiler is to originate this form by which he tabulates all case records. This year we are getting up a study of records on appendicitis so that we will all be together and be studying the same thing and talking the same language in the

department of general surgery and the department of pathology. This type of procedure furnishes many advantages: an interesting meeting for the entire staff; a valuable contribution to clinical surgery in the hospital; a monograph on the subject for each of the staff members; a demonstration of the value of complete and well written records; a demonstration in detail of points wherein the records on a given series of cases are incomplete, unreliable, or worthless, and of the seriousness of such delinquencies to the clinical files of the institution from a scientific standpoint; the establishment of an adequate plan of scientific research in certain clinical problems from the records; the development of useful classifications; the constructive criticism of clinical forms; the proposal of minimum standard entries on record forms essential to proper compilation of scientific data in a given clinical problem; proof of the scientific value of good records; and inculcation by example of the scientific spirit in making and studying clinical records.

THE NURSE'S CONTRIBUTION TO THE MEDICAL RECORD

T. R. PONTON, M.D., Chicago: Emphasis is placed on recording of important symptoms as observed by the attending nurses. There are two systems in vogue: (1) to have the nurse who observes symptoms chart her observations; (2) to have certain designated nurses do all charting. In the former arrangement the charts are not so neat, not so legible, but contain more information. The disadvantage is that notations will be made by junior nurses not yet trained to distinguish important from trivial symptoms. In the latter arrangement, whereas the charts are neater, no particular person is responsible for observations and only those reported can be charted. A combination of the two systems might solve this problem. Temperature, pulse, and respiration observations could be made on groups of patients, recorded on a group sheet, then transferred to the individual sheet. One nurse could be held responsible for this but observations of symptoms should be recorded by the nurse who observes.

Observation forms should be uniform, with the same type of observation always recorded in the same place, in order to secure ease of reference. The graphic chart and the nurse's notes are the two forms used, the former having proved the better from experience. The doctor's orders also should be written. The best system is that in which the doctor writes his orders in a separate duplicating order book from which the nurse transcribes them to her "orders for treatment" sheet. Cancellations are also written in the same book.

Discussion

LAURA R. LOGAN, B.A., R.N., Chicago: The nurse's record is of vital importance. It should be a permanent record. Two types of observations should be charted—both mental and physical reactions, the latter involving a great many items —thus accomplishing the objectives of charting among which accuracy is one of the most essential. The purposes of charting are: (1) to give the doctor accurate, detailed information of the hourly, daily, or weekly progress of his patient, portraying symptoms which indicate any change in the patient's condition; (2) to train student nurses in accurate observation of significant symptoms and the proper recording of same; (3) to aid the physician in following the course of the disease or in arriving at conclusions as to treatment; and (4) to give an absolutely honest record of the patient's entire stay in the hospital.

The head nurse of the ward must be responsible for the quality of charting. Accuracy requires her constantly to check and recheck the charts by her own observation of the patient as well as by the doctor's order book; to point out to each student nurse any error she may have made; and to comment on the accuracy of the observations of the student nurse.

A. L. LOCKWOOD, M.D., Toronto: I am particularly interested in the question of records from the professional man's point of view. I have been impressed for some time with the great necessity of attempting to boil down into figures all the facts that we, as medical men, want. It has been stated that figures can be so compiled that they will not mean anything. On the other hand, I do not believe any of our real knowledge amounts to anything if it is not substantiated by cold facts and figures. In the Lockwood Clinic we have endeavored for a period of 7 years to boil down all the data in regard to the patients that come under our care, no matter whether such data are of an academic nature or of importance from the point of view of the diagnosis, the method of treatment—medical, surgical, or whatever it may be—and the after-results. We try to boil our data down to a matter of figures, then chart it graphically, placing it where all the members of the staff see it daily. A great deal of the work of reducing data to figures and graphic charts is done by the girls who work in the library and in a combined library and record department, one girl becoming an authority on medical literature

relative to the various classes of records, and the other a real authority on records. Accuracy must be emphasized above all else.

The general discussion was conducted by EDITH M. ROBBINS, Boston, and the following problems were presented:

Making annual reports more interesting. The Cushing-Christian report of the Peter Bent Brigham Hospital, Boston, was described in detail. This report presents the material in a most readable and interesting manner, reviewing the past and looking forward to the future. Statistical data follows the Massachusetts General Hospital classification of diseases.

Maintaining the privacy of case records kept in the wards. Case records should be kept in the ward while the patient is in the hospital but not for inspection by others than doctors, internes, or nurses concerned with the diagnosis, treatment, and general care of the patient. The physical arrangement and management of the ward or unit should provide this privacy. It was also stated that occasionally there might be information of a nature so extraordinarily confidential as to warrant keeping it in the record room all the time.

Printed standing orders. It was deemed advisable to standardize routine procedures in the hospital as far as possible and have these printed for distribution to facilitate the work of the attending doctors, internes, and nurses.

Methods of securing histories. GRACE W. MYERS, Boston, reported that for the last few years at the Massachusetts General Hospital medical students from Harvard Medical School and other nearby medical schools have acted as assistants in taking records, thus early learning the proper method of writing histories. According to R. C. BUERKI, M.D., Madison, a similar system is carried out at the Wisconsin State General Hospital, Madison. The history and physical examination made by the student becomes a permanent record which both the interne and resident must check over and correct. In this way the student does better work than when the histories were destroyed after being written. ROBERT JOLLY, Houston, reported that owing to lack of internes he used a graduate nurse to secure histories and the attending doctor added the physical findings. A few hospitals adopt this procedure but the general consensus of opinion was that the attending doctor himself should write the record, or, if assisted by internes, nurses, or others, he should be responsible for its accuracy and completeness.

Records in the study of cancer. GRACE W. MYERS, Boston, stated that she saw no reason why a well trained record librarian who has been sufficiently instructed in the work and knows what a perfect record is should not be capable of securing accurate histories of cancer cases. The securing of adequate records of cancer cases presupposes more complete data than for the ordinary record, with a far-reaching investigation into heredity and negative findings.

Nurses' notes. MURIEL E. ANSCOMBE, R. N., St. Louis, stated that nurses should be carefully taught to observe symptoms and intelligently record them. The doctor's notes should be his own observations which, naturally, are written in more technical language than the nurses' reports. In the opinion of Mrs. G. HARRIES, Chicago, doctors and internes should verify the nurses' notations on charts, then make their progress notes. ADDA ELDREDGE, R. N., Madison, expressed the viewpoint that the nurse should make no attempt to diagnose, nor should her observations take the place of the doctor's observations. But as the doctor and the interne see the patient only occasionally they can ascertain from the nurse's record if what they observe at the moment is true for the rest of the 24 hours. We know quite well that a patient may show some symptoms when the doctor is not there that he will never see.

STANDARDIZATION OF SURGICAL DRESSINGS AND MATERIALS

FREDERIC H. SLAYTON, M.D., Chicago: When the American College of Surgeons undertook the standardization of surgical dressings, many hospitals submitted, upon request, statistical data and samples of various sponges and dressings totaling over 4,000. A careful analysis of these was made as to type, dimensions, and general structure, and the economic aspect of production of these dressings was also considered. As a result of the survey, to which extensive care was given, we may make the following general provisional classification: (1) dressings for sponging or wiping; (2) dressings for walling off; (3) sterile gauze to cover incisions or wounds; (4) dressings to absorb drainage after operation; (5) gauze drains and tampons; (6) bandages; (7) binders; and (8) dressings for specialized purposes. Types under these headings have been selected and as soon as the production engineers of the several co-operating firms give their report the final selections will be published in a manual, together with information pertaining to these dressings as used in hospitals.

It is quite evident from an analysis of the data collected during this survey that the usual method today of providing surgical dressings in the hospitals lacks uniformity, both as to manner of

preparation and type of product demanded and usually furnished. It is reasonable to assume that the cost under the present method may be excessive and, while not a major factor in hospital expense, it is nevertheless worthy of a comprehensive analysis.

Discussion

HUGH SCOTT, M.D., Hines, Illinois: In addition to the standards of the College, we, at the Veterans Hospital, have our own standards and equipment specifications furnished through an organization in Washington working in conjunction with the Bureau of Standards. All the gauze, bandages, and adhesive plaster we use must meet the requirements of the Federal Specification Board. This means greater economy and efficiency in the administration of the hospital.

THE VALUE AND IMPORTANCE OF THE HOSPITAL OUT-PATIENT DEPARTMENT

IRVING S. CUTTER, M.D., Chicago: The hospital should be the first thought in illness rather than a last resort; hospitals should therefore be so organized and equipped as to give the maximum service to ambulatory as well as to bed patients. The out-patient clinic may be in a separate building but is probably more efficient as an integral part of the hospital building. There should be physicians' offices, examining rooms, and laboratories for routine work with close cooperation between the general hospital laboratories, all of which makes for more economical and efficient medical service. The out-patient clinic is applicable to pay, part-pay, and wholly free cases, as may be determined by the location of the hospital, its obligations to the public, and the endowment provided for free care—ambulatory or bed. If free or part-pay service is contemplated social service personnel is required.

Discussion

HERMAN SMITH, M.D., Chicago: The out-patient department has an important place to fill, particularly in the larger hospital. It deserves as much attention as the in-patient department from the standpoints of organization and administration. This presupposes competent, well organized lay and professional staffs. While the primary function of the out-patient department must be the care of the ambulatory patient, the department must not overlook its responsibility for the education of doctors, internes, and nurses; for the prevention of disease; and for the promotion of clinical research. If the out-patient department falls short of this responsibility it is not fulfilling its real purpose.

LEWIS A. SEXTON, M.D., Hartford: There are a few additional benefits to be derived from an out-patient department: it will serve the general hospital in training future members for the staff; it acts as a clearing house, and a very good one at that, preventing many very poor diagnoses; it aids in prognosis, for a long continued observation of thousands of cases can, better than any other one thing, aid a physician in prognosis; it relieves the hospital wards of about 15 to 20 per cent of the cases that would otherwise be in the hospital, and is much less expensive than to have them in a hospital ward.

WHAT CONSTITUTES AN EFFICIENT CLINICAL LABORATORY SERVICE FOR A HOSPITAL?

FRANK W. HARTMAN, M.D., Detroit: The laboratory service will be adequate if it is under the supervision of the right type of physician-director, because such a director will not tolerate inadequate working facilities. Standardization programs should emphasize the laboratory personnel above and beyond, but not to the exclusion of, building and equipment. The laboratory and the pathologist should be rated on their capacity and willingness to assist in diagnosis, treatment, education, and investigation.

Experience has shown that in the larger hospital the work can be divided advantageously into morphological pathology, bacteriology, basal metabolism, chemistry, clinical microscopy, and serology. For the best results the physician-director should take a principal part in the morphological pathology. In the larger institutions the pathologist must do his utmost in supplying the present urgent need for well trained physician-directors and laboratory assistants. The ideal situation is that in which surgical pathology is handled by the department of pathology and the surgical staff meets with the pathological staff to review the material.

In the hospital laboratory the course of instruction should include, approximately, 4 months in bacteriology; 4 months in physiological chemistry; 3 months in serology; 3 months in clinical microscopy; 2 months in basal metabolism; and 2 months in tissue technique.

Discussion

OLIVER W. LOHR, M.D., Saginaw, Michigan: The Central Laboratory of Saginaw, which services 3 hospitals comprising 403 beds, was established 8 years ago. Nurse technicians were trained in making the usual routine examinations

—urinalyses; blood counts; collections of blood for Wassermann tests, blood groupings, and chemistry—and making smears for gonococcus and malaria, other laboratory procedures being performed as indicated by the attending physician. This routine service is compulsory if the patient remains over 72 hours, for which a charge of five dollars is made. Charity cases, however, receive laboratory work in the routine manner without charge. When indicated these services are rendered: examination of spinal fluids, of sputums, of pleural, ascitic, and abscess fluids, and of fæces; gastric analysis; cultures; and inoculations. An extra charge is made for other examinations than the above. All positive reports are sent to the physician immediately, the rest within 24 hours. The laboratory has modern equipment and offers educational facilities to all interested. The quota of autopsies has been maintained, and demonstrations of the latter are given at all staff meetings by the pathologist.

P. F. Morse, M.D., Detroit, stated that it is absolutely impossible for the small hospital to have a full time pathologist because there are not enough patients to keep him interested even if the hospital could afford to engage him. Very often the political situation enters into the normal solution of combining several moderate sized hospitals and employing one pathologist. Harper Hospital, Detroit, is endeavoring to assist the small hospitals in this respect by providing personnel to do their autopsies and other work. This will assist them in meeting the requirements.

J. J. Moore, M.D., Chicago, stated that no hospital of 100 beds can engage a competent pathologist unless it is an endowed or a municipal institution. Some hospitals state that they have a full time pathologist when this is true in name only and actually they have none at all. This matter should be checked up through more complete inspections.

WHAT CONSTITUTES AN EFFICIENT ANÆSTHESIA SERVICE FOR A HOSPITAL?

Wesley Bourne, M.D., C.M., M.Sc., Montreal: To have an efficient anæsthetic department it is well to have a staff, sufficient for the number of operating rooms, of expert anæsthetists, preferably graduates of medical schools who have served some time in interneship. The senior anæsthetist should be accorded a place on the medical board with rights equal to the other members. Briefly, the chief anæsthetist's responsibilities are: (1) the care of anæsthetic appliances and requisitions for new apparatus; (2) the keeping of records; (3) the allocation of work; (4) the teaching of housemen and students; (5) the conduct of frequent colloquia; (6) the encouragement of scientific investigation; and (7) the maintenance of harmonious co-operation with the surgical staff.

Discussion

Isabella Herb, M.D., Chicago: Emphasis must be placed on the importance of medical graduates as anæsthetists and the need of organization of an anæsthetic staff. It is my belief that the patient should be responsible for the anæsthetist's fee, receiving the bill directly from him.

John Lundy, M.D., Rochester: In this country it does not seem practical to have a staff of medical men as anæsthetists. In some institutions the anæsthetist may be a dentist; in others the anæsthetic may be administered by nurses, sisters, or others. Dr. Kris of Boston has very well exemplified the value an anæsthetist of competent judgment may be to his associates. The situation in the Walter Reed Hospital in Washington, D. C., where Dr. Gallaher is in charge of anæsthesia, illustrates the shock treatment that can be taken care of by that group constituting the department of anæsthesia. Medical men should make as great use of the department of anæsthesia as the surgeon and should furnish certain lectures on the subject to nurses. The department should assume the responsibility of indexing its records under the direction of the superintendent of this department. Literature on anæsthesia should be read and abstracted by members of the board of anæsthesia and made available to the student nurses.

An anæsthesia record blank should record: (1) preliminary treatment; (2) time of anæsthesia and operation; (3) blood pressure—graphically or otherwise; (4) condition of patient; (5) effects of anæsthetic; of medication; of blood transfusion; and of sodium chloride, gum acacia, or glucose solution; (6) extent of operation; (7) number and type of drains; and (8) list of operating personnel. During operation the color of the skin and blood, humidity of the skin, and relative temperature should be recorded. Considerable space should be given to "remarks" which serve one of the most useful purposes of any part of the record.

A PLAN FOR INCREASING THE NUMBER OF AUTOPSIES

Maurice Dubin. Philadelphia: At the Mount Sinai Hospital in Philadelphia a campaign was organized in September, 1927, to raise the percentage of autopsies which was then practically nil. Within 4 months this was increased to almost 50 per cent by adoption of the following plan:

One person—in this instance the chief resident physician—was appointed to make the request for permission for autopsy. Each month a report was given at the staff meeting of the number of autopsies performed, which was compared with that of the previous months. Members of the medical staff and personnel, before having the right to solicit postmortems, signed a statement agreeing such such examination upon their own bodies. To derive full benefit from these studies the pathologist was accorded sufficient time, assistance, and equipment to present his findings at staff meetings.

Discussion

FRANK J. NOVAK, JR., M.D., Chicago: Postmortems in this country are lamentably few. First I thought the fault lay with the interne, then I thought the fault lay with the medical schools, but now I believe that when a candidate is admitted to a medical school some machinery should be devised to determine whether that particular potential student has within him that divine spark of curiosity, so needed. If such students, and only such students, were admitted to the schools it would not be necessary to hold meetings to discuss plans and methods of obtaining autopsies, for the men would insist upon them.

NEED FOR CONSULTATIONS IN THE CASE OF THE SERIOUSLY ILL

FRANK H. LAHEY, M.D., Boston: The doctor called in consultation should be furnished with all necessary information and, if possible, the physician in charge of the case should be present. A nurse should not accept a consultation unless it is in written form. When hospitals can establish the spirit in their midst that a consultation will be given with every helpful desire and with the very least degree of criticism then they will have accomplished the greatest good.

I do not believe every nurse should work in the operating room for a surgeon and run the operating table; it is infinitely better that there be a graduate, experienced operating nurse provided, and that the nurses obtain their training under these graduate nurses.

I feel very strongly in accord with everything that has been said regarding the development of anæsthesia; we can no longer be satisfied with the relegation of anæsthesia to relatively inexperienced people; neither can surgeons righteously assume the position that they are in control of anæsthesia. The anæsthetist today must be accepted as a clinician; he estimates risks, segregates the cardiovascular, determines the selective type of anæsthesia which fits certain individuals, experiments in preliminary narcosis, etc. A standard of anæsthesia should be adopted, although this standard should be elevated only gradually to these ideal heights, out of consideration for certain institutions without extensive financial resources. The ideal scheme of anæsthesia, which is not always possible, is for the anæsthetist to work as largely as possible with the limited group of men with whom he can establist and keep an intimate contact.

Discussion

JOHN S. HARGER, M.D., Chicago: Borderline conditions as well as serious cases warrant consultations free from prejudice, in which the patient's best interests are primary. Practically all hospital cases are now influenced by the counsel of the laboratory technician, the roentgenologist, the pathologist, and an able diagnostician. The serious case is always entitled to counsel, regardless of the patient's financial status, and in borderline cases the surgeon should have the counsel of the internist and vice versa. Oftentimes several consultants representing many specialties are necessary to reach a satisfactory conclusion. Consultations, however, increase hospital costs unless the work is being carried on in a charitable institution or unless there is that *esprit de corps* among the staff members whereby advice can be secured without the usual consultation fee.

ROUND TABLE CONFERENCES

The following topics were discussed at conferences conducted by Malcolm T. MacEachern, Chicago, and Robert Jolly, Houston:

Case records. Accurate and complete case records should be kept for private as well as public patients. No distinction should be made. There are various methods in vogue for securing case records through the attending doctor, the interne, the graduate nurse, or the trained record librarian, the latter two when it is impossible to secure internes. When secured through the interne, the graduate nurse, and the record librarian, their data and findings must be supervised by the attending doctor himself. The interne should make the physical examination, but this must be checked over by the attending doctor. When the record is secured by the graduate nurse and the record librarian the attending doctor must add the physical findings. Sometimes arrangements can be made with the young graduate of medicine practicing in the community to assist with case records, providing such a plan

meets with the approval and co-operation of the medical staff. Each tonsil case should have a complete history. It is not necessary for the attending doctor to sign each page of the history provided there is a covering statement somewhat as follows: "This is to certify that the undersigned has carefully reviewed the data and findings in this report and to the best of his knowledge believes them to be accurate and complete." A copy of the doctor's office record should be acceptable if complete.

Internes. Many hospitals have great difficulty in securing and keeping internes. There are numerous instances where internes have broken their contracts. The cause of this condition was ascribed to lack of interest or organization on the part of the hospital management or medical staff, or perhaps both. The hospital management and the medical staff must jointly assume responsibility for seeing that the interne receives a carefully supervised, worth while medical education and experience while in the hospital. Each member of the medical staff should constitute himself a teacher for the interne in his daily contact. Group and individual interest and responsibility for the welfare of the interne are essential.

"Open" versus "closed" hospitals. The "closed" hospital has the advantage of a carefully selected medical staff affording better control over the professional work and the scientific policies. It permits more uniformity of action and standardization of procedures. It, however, does not afford the general profession the opportunity to keep abreast with the progress of medical science. The "open" hospital can be so regulated as to be under adequate control, provided: that the medical staff is properly organized; that it lays down definite policies regulating the professional work; and that these policies are approved by the governing body or board of trustees and carried out by the management of the hospital, with the support of the medical staff. Better control can be effected through establishment of the following: (1) due care in the extension of hospital facilities; (2) system of annual extension of hospital privileges and staff appointments; (3) strict enforcement of the rules and regulations. All "open" hospitals should be strictly controlled if they are to attain the standard of efficiency of the "closed" hospital.

Anæsthesia. The choice of anæsthetic depends upon the type of case, the operation, and the anæsthetist. The use of ethylene as an anæsthetic has been claiming more attention in recent years. So far as known, the safety of this anæsthetic depends upon the following conditions: (1) efficient administration of the anæsthetic; (2) freedom of the anæsthetic and operating rooms from static electricity—in this connection, it is to be noted that proximity of the X-ray department should be guarded against; (3) known humidity of the air in order that it should not exceed the margin of safety. The use of a hydrometer to gauge the humidity is desirable. When a humidifying apparatus with a thermostat can be installed the humidity may be kept at a definite point.

Ethylene, according to Dr. John Lundy, Rochester, Minnesota, has been administered 33,000 to 34,000 times in The Mayo Clinic without accident. Nitrous oxide with oxygen is a safe anæsthetic in expert hands because of the readily available supply of oxygen. Local anæsthesia under proper conditions and technique has made splendid progress in recent years.

Clinical laboratory work. The clinical laboratory should be made self-supporting as far as possible. The system of charges is still a controversial question, but the flat rate is favored by the majority of hospitals. The flat rate should include the cost of tissue examination, but there should not be any charge for autopsies. In the flat rate method there is sometimes need for restriction. The proponents of the schedule of individual charges believe that this is the best method to regulate laboratory work. They believe that the doctor or interne should say what laboratory work is required rather than leave it to be determined by a routine flat rate method.

Apparently, not all doctors appreciate the full value and importance of laboratory work and too often cases which come up for discussion in the staff conference show a distinct lack of sufficient laboratory work. This makes it clear that there is still need to educate doctors in this matter. Laboratory technicians should be well trained, having at least 1 or 2 years in a recognized university. Such a course is now being given at the University of Minnesota. Laboratory work from the outside should be guardedly accepted by an approved hospital. The American College of Surgeons requires that, to be acceptable, laboratory work handled outside the hospital must be done in a laboratory approved by the Council on Medical Education and Hospitals of the American Medical Association or in the clinical laboratory of a hospital approved by the American College of Surgeons. This is necessary to insure efficient and reliable service.

Legal responsibility of hospitals. The legal responsibility of hospitals, through their governing bodies or boards of trustees, is becoming more and more clearly defined. There are a great

many decisions on record which make the law quite clear. In the absence of statutory provisions in the various states, practically all the higher courts support the theory that the governing body or board of trustees is legally responsible to the extent of exerting due diligence and care in the selection of those who work in the hospital. "Though the relation of master and servant cannot be said to exist between the hospital and the physicians and surgeons attendant on it, the hospital does nevertheless assume the responsibility in that it uses its own judgment or that of its trustees in selecting them and impliedly therefore undertakes to exercise reasonable care to get such as are skillful and trustworthy in their profession. The patient has a right to rely on the exercise of such care and consequently if through neglect of the hospital to exercise it, receives an injury, the patient is entitled to look to the hospital for indemnity unless the hospital enjoys some extraordinary exemption from liability as might be afforded by a special act of the legislature as in the case of the State of Massachusetts."

The Conference was brought to a close by a unanimous resolution of appreciation tendered to the American College of Surgeons for the service it is rendering the field through its Hospital Standardization Department.